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A Planning Practitioner's Reflections on Managing Complex Scheduling Challenges

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Disclaimer

The views expressed in this research project are those of the author and do not necessarily reflect the views of the supervisory team, Middlesex University, Airbus or the examiners of this work.

Non-disclosure/redaction policy adopted (NDA)

A NDA was considered at the outset of this study, when analysis was proposed in detail on specific product cycle times and staffing-hour behaviour.

The election to proceed on personal epistemology, referencing external work and abstract generic summary data, rendered this submission in line with other standard academic/educational submissions.

On this basis, an NDA has been discounted.

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Contents

List of tables

List of figures

Glossary of terms

AC	Aircraft
AKC	Airbus key competency (a skill that the company would like to encourage and develop)
APC	Airbus planning and control (IS tool for managing planning transactions)
APM	Association for project management (a professional body/institute)
ATP	Advanced turboprop (a type of aircraft)
CFRP	Carbon fibre reinforced plastic (a material choice for some aircraft components)
CI	Continuous improvement (an iterative process of evolving/changing processes to improve)
COC	Centre of competence (a hub of professional expertise)
DFM	Data for manufacture (key data required to start build of parts and assemblies)
DFMRP	Abridged/piecemeal release of DFM later than planned in smaller data bundles
DMU	Digital mock up (an IT enabled screen view of design as it matures)
EIS	Entry into service (the point when a new aeroplane can begin to take on passengers)
FAL	Final assembly line (where complete aircraft are put together)
HOV	Head of version (means the 1st aircraft to a new customer Standard, Air France for example)
LE/TE	Leading edge and trailing edge (large sub-assemblies found at the front/rear of the wing boxes)
LR	Long range (a longer distance/larger aircraft in the Airbus range of product offerings)
ME	Manufacturing engineering (where methods and processes are developed)
MCA	Major component assembly (a wing or a fuselage section, for example)

MFT	Multifunctional team (a group of people brought together from various disciplines to discharge a task)
MG	Maturity gate
MRA	Multi-rater assessment (a form of feedback in 360 degrees on an individual's behaviours)
NDA	Non-disclosure agreement
NEO	New engine option (a fuel saving product improvement)
NRC	Non-recurring cost (such as the cost of major building works to accommodate a change)
OSW	Outstanding work (activities planned in one plant, but completed downstream in another)
PAX	Passenger version of an aircraft (rather than a Freighter version)
PBS	Product breakdown structure
PMO	Project management officer
P&PM	Project and programme management (an internal to Airbus PMO community of practice)
RC	Recurring costs (such as the per ship set cost of transport for each item shipped)
RSP	Risk sharing partner
SA	Single aisle (a short haul aircraft in the Airbus range of product offerings)
S&OP	Sales and operations planning (a top level monthly review of changing demand patterns)
STVs	Standard time values (a detailed assessment of work content per task)
TLR	Top level requirements (such as the need to fly 350 passengers or a range of 5000 nautical miles)
UCOP	Unit cost of production (a finance measure)
WBS	Work breakdown structure

Context Statement

Abstract

This work represents the reflection-on-action of a planning practitioner from the field of aircraft manufacturing who manages between 40 and 50 planners at any one time and who has influenced the development of many others over the last twenty years. This is an industry of considerable scale and complexity that requires an appropriately positioned planning and scheduling response. From the perspective of the head of planning (Wings), the key impact on the practice reflected upon here is on the integrated positioning of **planning into a critical community** (a centre of competence), where the roles and the interaction provide an appreciative framework for planners to give of their best.

The four core themes explored in this work start with the **way of working** embedded in an integrated planning approach to enable a route into the wider organisation and how the tasks become clarified in this setting in terms of scope; how a cross-team supportive approach is established; how role gaps are anticipated; and how retaining and using experience is thought about, while reinforcing appreciation through continuous improvement activity and professionally maintaining the pool of planners.

An integrated approach then supports the spread, sharing, development, accessibility and application of **knowledge** in more resourceful and relevant ways than if the approach was task-orientated, boundaried and transactional. This is illustrated by examples of why learning curves matter and how they may be interpreted for impact, and why using governance templates to clearly capture planning outcomes is so important.

Examples of **tools** are given that both support and emerge from an integrated planning approach: cardinal rules, red reports, plan-on-a-page and sign-off packs that can secure a professional planning input.

All of the above are positioned in an understanding of how **complexity** builds up during the phases of a major aircraft development programme, before maturing to the series build phase that follows a launch.

This critical engagement places these themes in context within both practice and related literature. These reflections have the potential to enrich the body of knowledge in this field, as the role perspectives currently in the public domain are either based on only one or two launch cycles, at best, or have the limitation of only part of the five to seven years it takes to deliver a new aeroplane, from drawing board to market. This reflection-on–action is based on multiple cycles, giving a wider perspective over a longer time.

I propose that this exploration into complex planning has the potential to effect significant change in the professional role of a planning practitioner. It does so through recontextualising the planner's role as both facilitating articulation between different stakeholders and developing a range of practical products and tools that structure and delineate how this re-conception of the planning role operates in complex environments. Of key importance to this is the value of ongoing critical reflection of the role as a form of leadership, based on indicators of trust being maintained.

Introduction

It is a key aim of this critical engagement to capture the values, motivations and outputs of my professional input, so that potential planners do not just learn a system but pick up ways of looking at things that may, at this point, be influenced by me yet should be able to be continued and be developed without me. This way of looking at things and the drive I have to take on and develop the planning role in the way I have did not spring newly formed when I took on this role, but draws on traits and values shaped during formative experiences that I can trace back to pre-school years.

My industry functions in layers of context, with each exerting its own influence. I am in a sense a part of a context for others, therefore my engagement with values and motivations is a necessary part of understanding the overall context. This highly complex work context has influenced how I have organised and presented the critical engagement, which includes an exploration of my values and motivations shaping this approach.

As a head of plant scheduling and planning in the aircraft industry, taking this work-based learning approach has afforded me the opportunity for self-reflection on and critical analysis of the knowledge I have accrued over several decades. The information that guides me in exercising judgement is based upon this knowledge.

I have been able to evaluate my ontology and how my way of 'being in the world' and perceiving reality shapes outcomes within the setting of my work context. I have been able to see how my values and deeply held convictions aid (or hinder) me in overcoming ethical and or moral dilemmas in discharging my roles and gaining critical acceptance of outcomes, based upon what I know and understand about planning within a complex super-value goods industry.

Methodology

For this critical engagement I adopted a **methodology** of using a schedule-based framework to provide the glue that links the various strands of practitioner-led research together. This is not surprising for someone with a scheduling background. I like the idea of 'maps that work' (Costley, Elliott & Gibbs, 2010: 86) and recognise that since this is how I conduct myself in a work context, it felt natural to reach for a schedule map in this piece of personal research.

I have paused briefly and stepped back from my day-to-day practitioner role and how I interact with different stakeholders and audiences, and the impact these have had upon my outputs. In my approach to this I recognise that I have elected to pursue what Nicolini (in Ybema et al., 2009: 128) refers to as **a rhizomatic pattern to my research** that 'starts in one place with an in depth study of that specific location and then spreads following emerging connections to other practices, which in turn become the target of a new round of zooming in'. I have aimed for just the right amount of detail to **secure a trustworthy text**, which Schwartz-Shea and Yanow recognise when they assert that 'a central feature of **ethnographic** writing is its extensive description of the place or space in which the research was conducted, as well as its context'(Ybema et al., 2009: 65).

In attempting to understand research paradigms that fit this approach and my naturally enquiring nature, I have been informed by critical theory, in which

convictions on key themes have emerged through time with knowledge that has been subjected to individual/cultural construction (Costley, Elliott & Gibbs, 2010: 116); social constructivism, in which the individual and social element combines with my role as an involved participant; and ethnography, capturing practices through intense observation that lead to opportunities for change. I have considered what 'good' looks like from a philosophical standpoint and have enjoyed reading up on the many and varied definitions of how it may be identified. Dickinson's (1906) view of 'the general good' (p35) is the one that resonates most with me in terms of the work context in which I find myself considering it. In my industry, the notion of 'good enough' would be that which is as good as can be, within the contextual constraints at the time. Through my eyes, the 'general good' is one that appeals to the widest transdisciplinary interpretation and comes closest to when 'we act simply and without reflection… based as it is on common sense' (ibid.).

As a consequence, the public works I have chosen are those which best demonstrate the themes with which I have been engaged for some time and which I believe are of value to complex, high-value manufacturing: ways of working; tools; and knowledge and organisational engagement in an environment of complexity. They function as devices that facilitate rapid and logical navigation through the complexity to arrive at results that satisfy all the other stakeholders in the working environment (planners, engineers, suppliers, business analysts, human resources professionals, accountants, policy makers, and several more groups and individuals). In preparing for this work I have had access to and drawn heavily on hundreds of my own plans and policy-shaping papers addressing a wide range of senior level transnational audiences over many years, encompassing several companies. I expected that this would prove difficult to filter into appropriately focused themes for a piece of work like this, and it did. What I had not anticipated was the ethical choices inherent in positioning this work for a doctoral submission.

I found a critical choice in front of me at a relatively early stage: to press on and quote highly specific examples from clearly identified products and companies (along the lines of 'when I was working on product X planning...'), which would have led to two consequences: first, the need to protect the reputation of

individual people who would either be named or easily (but inadvertently) inferred from the data provided; and secondly, the need to provide an over-arching non-disclosure agreement (NDA) to guard against indiscreet or inappropriate use of the detail in the resulting work.

The alternative path was to obscure the individual products, projects, companies, components and people by referencing an atypical product, project, company, component as an amalgam of all that I have experienced in working with a number of companies. This would allow the submission to proceed, ethically secure, without the need for either an NDA or obvious and clumsy key fact redactions, but at some small risk that the quality of the work might suffer through the lack of specific detail. I chose this alternative approach and have gained much more personally in considering this perspective than I would have if I had continued down a path of cataloguing a dry/factual time-line in a specific event-driven narrative.

The choice to summarise atypically, then, has turned out to be not just a convenient way of negating some of the non-disclosure/ethical dilemmas, but the most appropriate method for me to draw learning from the experience for myself and to capture knowledge for others in the most apt way. It has allowed me for the first time to stand back and review my career learning to date in a research model that frames my experiences in an academically acceptable format. It has allowed me to put structure to what reflection-in-action has led me to know, and to work more fully on articulating some of the dominant themes in what knowledge I have accumulated.

In summary **the research methodology** that I have deployed over the two years on the programme, and three years prior to that while preparing for this undertaking, has centred on Schön's reflection-on-action (1983) from an insider–researcher perspective. Reflection on one's practice is at the centre of a work-based learning approach, as proposed by a range of writers influenced by Schön, including Costley, Elliott and Gibbs (2010), Ybema et al. (2009), and Carr and Kemmis (1986).

I have found autoethnography (Ellis & Bochner 2000) to be a useful framework to guide my engagement with my own knowledge output and the 'culture' from

which they both emerge and in which they function. The autoethnographer seeks dialogue with the inhabitants, beliefs, materials and artefacts of his/her own 'culture' in order to more clearly understand the researcher's place in it and the dynamics of the interactive influences. As part of this auto-ethnographic engagement I have had conversations with co-workers and played back to colleagues pieces of this work as it unfolded. This was to invite their responses to my perceptions of my role and actions, and the impact I have on creating such perceptions in them and their influences on my role. This interaction has helped me to understand where I need to develop my own understanding, and to articulate my views so they can be shared and exchanged with fellow members of my culture.

It was a revelation to discover that I do, in fact – and always have – to some extent practised reflection-on-action. I now see myself as having so much more to learn to shape the effectiveness of how I act as a **reflective practitioner**, for that is how I now see myself, as an active 'process actor' who practises **reflection-on-action** and who is learning its skills and arts (Schön, 1983: 49-69, 276-278). I have also found it easier through such reflection to select the key public works among many to help me bring life to the **explanations on key moments in practice** for me. These have fuelled auto-ethnographic/autobiographical insights and given more substance to the themes. This has led me to think about thinking, evaluating critically and considering more deeply 'what is right' in a complex work setting with many competing ontological validities.

Audience

I have been asked on a number of occasions who the audience is for this critical engagement. First, it is for myself, as the author/creator of the public works, to help me to go on developing in my practice. Also, it is to gain more insights into complexity by accessing literature outside of my specialist area that I would not normally, to inform any new public works that I design to create a conducive and productive environment for those we plan for, and for other planners in my industry. Secondly, and collaterally, this critical engagement could offer some insight to young trainee planners about what it is like to be a senior planner in a complex industry. There are some things that cannot be taught on courses and workshops. The learning also comes from experience, if there is the capacity to

reflect on action and eventually to reflect in action. Thirdly, it may also be of interest to planners in other organisations, insofar as it provides encouragement to other master planners to reflect on their work and to begin to write critical accounts so that knowledge gaps can be filled and a critical approach to practices passed on to succeeding generations of planners. I have given talks to members of other complex industries who have found my approach to planning, developed more deeply through this critical engagement, to be of value. Alongside this is the creation of artefacts that support integration of the different stakeholders' positions, concerns and work cultures that facilitate navigation to the end goal of successful and on-time completion.

Articulation of the context (see Chapter 3)

> When we go about the spontaneous, intuitive performance of the actions of everyday life, we show ourselves to be knowledgeable in a special way. Often we cannot say what we know. When we try to describe it, we find ourselves at a loss, or we produce descriptions that are obviously inappropriate. Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowledge is in our action. And similarly, the workaday life of the professional practitioner reveals, in its recognitions, judgments, and skills, a pattern of tacit knowing in-action. (Schön, 1995)

The greatest challenge has been not only to describe the industry but my own organisation, and to do justice to the complexity of the systems and procedures. This, in turn, is also about doing justice to what I have produced to facilitate navigation through the complexities. Not all high-value manufacturing environments are the same; what they share is complexity made up of internal and external influences, competing demands and a range of sectors and disciplines involved in the process of production. Each planning team has to develop a navigation system through competing demands and anxieties, timetables and components such as supply chain and critical incidents that can hold up the rest of the stakeholders. Planners are there to put order into potential confusion and to prevent a breakout of potential chaos. Success is not always put down to the planners, who are more often screens on which are projected the frustrations and the pressures of every other player in the process. It is my job to develop strategies that inhibit the emergence of confusion from complexity, and my public works are successful attempts to do that.

Practice and theory

I am not a theorist. I am a practitioner. When I work, I do not follow theories. I use literature from my own field and selected conferences to keep me up to date and informed. My experiences, and listening to those of other stakeholders and planners, are my most reliable informants. Practices can change on a daily basis, influenced by external and internal factors including changing methods, competition or new technological and scientific advances. Theory often takes too long to catch up with front-line practice. In the end, one has to be an informed pragmatist. Through this context statement I hope that I can theorise aspects of my practice that will be of use to myself and to others.

It would seem important then, to say something about what drives me to make the decisions I make and the way I operationalise them in an environment of often conflicting interests:

> adopting a practice approach radically transforms our view of knowledge, meaning and discourse. From a practice perspective knowledge is conceived largely as a form of mastery that is expressed in the capacity to carry out social and material activity. Knowledge is thus always a way of knowing shared with others, a set of practical methods acquired through learning, inscribed objects, embodied, and only partially articulated in discourse. Becoming part of an existing practice thus involves learning how to act, how to speak (and what to say) but also how to feel, what to expect, and what things mean. (Nicolini, 2013: 5)

This sums up for me what this critical engagement is all about.

Personal epistemology

If I were to distil my personal epistemology on this vast subject into one relatively small focal point, I would elect for the universal planning dilemma that sits at the heart of politically positioning any significant planning input: Who owns the plan?

This drives everything from the acquisition of knowledge through the distribution of baseline time and risk, to the reporting of progress and through subjective, often subliminal, bias that may even skew the facts upon which knowledge is balanced. Local, tactical examples would be as follows: a manufacturing engineering-owned plan would be based on networks and standard time values;

a logistics plan might optimise stock and inventory; and an operations plan would often favour smooth labour resourcing or machine loading. But overarching all these is the politically significant dilemma on how to distribute time between the various elements of design, make and buy, where they collaborate in an overlapping but essentially sequential flow that culminates in a customer delivery.

I have learned that more time for design in some companies seems like waste and procrastination to a manufacturer that wants to get on with ordering machinery and cutting metal, whereas learning curves and goods receipt windows seem like waste to a design engineer, and better spent on optimising the design for lowest weight or cost. Both are valid definitions of what is good, leaving a requirement for judgement to decide on how to proceed, based on reflection-in-action, accessible knowledge and experience. But as my reading has helped me to discover, even knowledge can comprise Type 1 (believed facts) and Type 2 (checked facts) modes of knowledge (de Bono, 1985: 32) and may be skewed by the subjective nature of their acquisition (Paul, 1993: xvi).

Therefore, relying on 'demonstrated performance' to interpret a future possible outcome, even when it is based on checked facts, powerful though the argument is, is not enough to secure critical approval. I found this out when confronted by, what felt to me, counterintuitive responses to planning inputs such as cardinal rules (covered in more detail later in this work). These were essentially logged as manufacturing protecting manufacturing by design engineers, and as plants protecting delivery outlooks by project managers and consultants seeking to remove schedule overlaps. It is worth adding that these are often seen as common sense by the plant organisations themselves.

A reflective key learning result for me that has been confirmed during undertaking this critical engagement is that planning is like policing: it only works through consent. Understanding these ethical, moral and perspective dilemmas has helped me move the argument for critical acceptance towards the middle ground. I have done so by appealing to consent through focusing on governance and sign-off of plans in a multifunctional approach that culminates in an open sign-off by all interested multidisciplinary key stakeholders to the

underlying assumptions. In this way, each can point to their own voice having been heard in the consensual engagement behind the release of a fresh plan.

This links well with the need to **integrate planning into a critical community** of roles that provides an appreciative framework for planners to accumulate knowledge, develop their judgement and practice their application within a **centre of competence (COC**) approach that stands apart from other, more traditional functions. This is in sharp contrast to a condition where planners may operate in small silos, segmented into transactional focused, more junior roles lost in the wider organisation. Therefore, I have moved an organisation towards plans prepared by higher level integrated planners with a range of skills, signed off to a template by a multi-function team (MFT) briefed on the knowledge/facts that underpin the trade-offs inherent in the plan. This all requires a conscious effort to nurture and retain the key data and knowledge upon which the planning rests.

This sense of professional community (Freidson, 2004: 202) aids the practice of discharging a key task in a complex and challenging environment, while encouraging and structuring knowledge retention by actively embracing and organising for promotion/development. This means accepting losses of key individuals and knowledge as a positive consequence of high profile roles and planning for them in a way that ensures continuity of judgement. It still appeals to the 'common sense' factor for me; that is, it is explained in a straightforward and simple way, but, crucially, this enhancement of working practice now embeds an agreed definition of 'good' as a consensus on core assumptions.

Summary of public works and themes

In conducting my role as the head of planning and in communicating policy, intent, coaching material, shaping papers and similar, I am producing and disseminating public works weekly, monthly and constantly, and have been doing so for a large part of my career. These public works vary from routine documents shared with domestic/local audiences of around twenty to fifty people to less routine works shared with transnational, cross-functional, multi-factory audiences in various sized groupings. The way that these are approached and the opportunity to reflect upon the underlying ontology have been the focus of this submission, as I have always recognised a degree of

uniqueness in my approach, yet was unable to frame this appropriately and academically before. I have not sought to publish any works in professional journals, as they are sector-bound internal public works that have already influenced practice and thinking within a large enough audience for me. However, the engagement with this work, and particularly the literature accessed, has opened my eyes to the possible transferability of some of this content and I am considering going to the next level of 'public' through publication in professional journals.

This critical engagement has placed the four core themes (way of working, knowledge, tools and complexity) in context, where context is an amalgam of product life cycle, organisational sponsorship and cultural norms, with personal epistemology and inherent character traits.

My intent has been to demonstrate a deeper level of understanding, to act in future a little less by accident on the themes that produce the most benefit, to emphasise the positive and lean more in the direction that has been revealed to me through study. It has been the opportunity for me to understand planning in a philosophical frame as well. I hope that I will have shown that I have explored and understood whether planning is there to conform, reassure, challenge, support, help or solve, and that I can now demonstrate a deeper understanding on what I contribute and why planning suits me. I believe that I have emerged better equipped to enhance and develop the planning organisation and my place in it.

Chapter 1 Engagement

1.1 An approach to critical engagement

'Intellectual wisdom is the capacity to not just solve problems but to see which problems matter and which of their aspects are crucial. In that sense it is a kind of good judgement, an ability to identify what is truly important' (Baggini, 2014: 43)

In reflecting upon reflective practice, my first 'aha' moment (Bolton, 2012) was realising that writing has been vital to unlocking reflective practice for me. My critical engagement with this doctoral research project can be traced back to an unrelated writing event that opened this professional development route. It started with the need to prepare a CV for consideration by an internal company accreditation panel that would assess my project management professional practice to date and award me with recognition for the experience I had gained. To prepare for this I accessed my rolling CV folders, where I keep records of achievement along with position changes and career highlights.

To use an analogy, this was a bit like analysing a hike up a hill after the event (please bear with me!). Accessing my rolling CV folders was a little like rooting through pockets full of the equivalent of hurried snapshots taken on the journey, the odd artefact collected en route (such as a leaf or pebble picked up along the hike). The prepared CV that I put together linked all of these snapshots and artefacts on a timeline (I started here, climbed to there, and collected this and that on the way). It was a rather dry, factual and sparse linking of a career's worth of experience. But it was all that was needed to meet the accreditation process.

The next stage of my enlightenment was sparked by the application I made to the Association for Project Management for consideration of acceptance at a fellowship level. This application required me to narrate and bring the CV to life with examples of what I had learned, rather than just what I had done and when. So, now I had to sit and reflect upon my journey so far, and, back to the hiking up a hill analogy, was a little like sitting at the top of the hill and, having already emptied my pockets, and having put the photos, pebbles and bits collected en route in chronological order, and recorded them on a simple map (the CV), I now needed to reflect upon what they meant individually and how these experiences had collectively added to my knowledge.

This doctoral undertaking is focused on professional studies, and has encouraged me to go further and consider why the journey was made at all (why climb this particular hill, and why do it in the way that I did?) by encouraging me to reflect deeply upon my motives, methods, ethics and by forcing me to articulate what I did and still do to a more refined and academically sound level. This submission started with numbers and pictures, and the rather dry recording of the facts and key events that linked them five years ago I now recognise was unstructured, un-reflective and lacking context. But, a layer at a time, I have come to identify critical events (Bolton, 2012: xviii) and a structure that link my experiences together in a coherent way. More importantly still, the literature reading in parallel with the writing-up process triggered questions and ideas that lacked relevance at first, yet grew in significance the more I read.

1.2 Positioning in current literature and academic journals

I am a specialist, living, being and operating in the scheduling role frame and context that are expanded upon in this piece of work. My experience stands in contrast to a researcher with a methodology for doctoral research, anchored deeply in academic literature, who might be reaching out for practical experience through work-based study or pilot projects, or case studies to find the practice in the field to illuminate the written testimony of others and possibly inform and challenge theory. I am in the inverse position, a practitioner already active in the field, aiming to share knowledge and practice, and wanting to illuminate this by reaching out for coverage or gaps in the prevailing literature to better position my own contribution to knowledge and practice.

In my role over the many years outlined, I have kept abreast of the relevant technical knowledge in my specialist area through e-mailed or posted journals and publications from the professional bodies of which I am a member:

- Association for Project Management (APM)
- Chartered Institute for Management (CIM)
- Chartered Institute for Logistics & Transport (CILT).

These provide a practitioner in my field with a route to published works on, for example, current project management practices and advances, general management and leadership practice, and logistical scheduling tools, some of which are referenced elsewhere in this work.

This is a fast access way in which a practitioner works with literature due to the speed of change. Like many others in the field, I supplement this regular daily and weekly inflow of information by following up on specific themes. This might be by seeking out further detail in a book or journal to supplement something that has piqued my interest, as it resonated with experience or through attending training courses or conferences on specific research outcomes impacting upon my field of practice. In this way, which is to say, a practitioner-based way, I absorb contributions to my understanding on subjects such as leadership in integrated contexts and how democratic, autocratic and laissez-faire approaches to leadership may be expected to impact outcomes (Chemers, 1997: 21) and on how **project managers** can elect to understand complexity impacts on large engineering projects (Rekveldt, et al., 2011: 728-739).

This does not represent an exhaustive analysis of the full technical journal domain, but it is in line with the way a professional in the field might choose to keep abreast of developments. This is because it is a clear route for an industrial practitioner to understand the separate transactional elements of his or her role and how this can be conducted as part of the standard suite of organisational roles, such as a project manager or a shop floor scheduler. This tends to be how all of the practitioners with whom I have had contact behave in the context I have outlined. They do not routinely navigate by academic journals: they have a job to do and reaction times to on-the-ground challenges can be the difference between success and failure. They need to balance research-level learning with maintaining professional development, at the same time as delivering the outcomes from a role, therefore a practice-driven selection process of reading dominates.

However, as this work is aimed at advancing knowledge and practice, I have needed to engage with the literature at a different level. This was not only to enlighten myself further through literature outside that which is directly pertaining

to planning, but to identify where gaps might be in the theoretical literature of my professional field.

In this spirit, I set out to uncover literature relevant to this field of enquiry.

Information and academic literacy require at the outset a selection of keywords, and combinations of keywords and terms, that may not immediately appear relevant to the particular focus of the researcher or enquirer. I found this not only an interesting exercise but one that was quite enjoyable, as it had elements of working out the rules of a game that would help attain a new level of difficulty. I started from the premise of single words that would establish useful boundaries to the knowledge domain to be accessed so that my searches might be focused in the right place:

complexity
in
planning
or
scheduling
in
production
operations
manufacturing
or
aircraft

Then I refined this to include various combinations of tense words/terms:

complex scheduling
planning for complexity
organising for complexity
managing complex production situations
complex manufacturing
scheduling for aircraft assembly
planning in complex aerospace settings
integrated planning or scheduling

The next step was to access the literature through appropriate databases primarily targeting journal papers post-2010, then allowing the search to move beyond these and into books or lecture notes to follow relevant references or citations.

In conducting this part of the process, I found that different sources offered advantages around certain themes: for example, I enjoyed accessing philosophical texts, hermeneutic and metaphysics-based reading that expanded my thinking about how, as humans, we understand and make sense of our world including through reflection, action, practice, creation of knowledge and plurality of truths. I found a rich resource for literature on management, planning, production and operations and leadership at Chester. Both of these sources helped to supply non-specialist, but nonetheless vital, general reading.

For the specialist journal articles search in my specific field (complex scheduling) I used a range of resources: university libraries; specialist databases; and search engines including Airbus intranet and Google Scholar.

Initial sector specific and specialist search results leading to an iterative response

The process evolved iteratively, with an article or journal piece in one area leading through citations, references or quotes to authors active in the field in another area. In this accretive manner, the process progressed through citations in searched journal articles into ever-widening circles that needed refining to help position this work appropriately.

I came at it from a deficit-based analysis, first; that is, asking what was missing from the literature that pertained directly to my professional practice and context. This was easiest as, the further from the centre of my practice and context that the keywords led me, the easier it became to identify the gaps. What proved more difficult was closing down the criteria and focusing more tightly to identify supportive scripts. This focus lay in coming back into the essence of the work, that is to say, the human factor and what needed to happen to influence people and their behaviour, in order to create conditions for an exchange between the different sectors to take place and working together successfully in a complex manufacturing arena.

I refocused the literature search on the following keywords:

Practitioner views on complexity
practitioner reflections/managing complex scheduling challenges (my title)

and, on the following sub-themes of integrated planning and complexity:

complex scheduling – ways of working
complex scheduling – knowledge
complex scheduling – tools and techniques
complex scheduling – layers of complexity
transdisciplinary planning and complexity

However, the more refined the field and the more additional constraints (such as ways of working), the less directly relevant material was uncovered.

These searches tended to show a leaning towards certain highly specific and context-bound outcomes so that, for example, searching for 'Managing complex production situations' yielded strong material on the development of algorithms and simulation to make sense of the complexity. 'Managing complex scheduling challenges' brought up healthcare/NHS scheduling solutions, as did 'practitioner views on complexity'. Finally, searching for 'complex scheduling/ways of working' brought up more spreadsheets, theoretical algorithms and systems solutions, which are not really at the heart of this discourse.

The richest seam of supportive texts was uncovered by the earliest and simplest keywords used (complex scheduling, and planning for complexity). The most useful examples of these sets of outcomes (directly relevant or indirectly linked) now follow, and I suggest this as a route for others interested in uncovering existing knowledge in the field and in following up on themes raised in my work.

Key supportive themes in the literature – a summary

I find that using a generic term such as **complexity** produces various useful perspectives and contexts. For example, there are journal articles on complexity theory, such as by Pitsis et al. (2014), which summarise various research papers, surveys, case studies and theoretical models. There are further insights into the development of strategy from a complexity perspective (Gregory & Ronan, 2014) based on project work in an educational setting. There is further reading to be found on complex business models, managing strategic paradoxes (Smith et al., 2010) that describe the link between complex business model types and vision/goal setting, and others on how to adjust algorithms to reflect increased complexity (Lakshimi & Vasantharathna, 2010).

Cegarra and van Wezel (2012) help expand on the key themes in my work by documenting that various case studies have reported the crucial contribution of extensive knowledge accumulated through years of practice. They call this **cognitive readiness** and go on to describe how adaptability, flexibility to the human decision-making context and acceptability all impact on this cognitive readiness: together this affects all areas of the work presented here. They offer good definitions of the different forms that scheduling can take in nursing and manufacturing, and discuss the sheer number of objectives that need to be balanced or met, a trait I recognise only too well. They then go on to discuss the unwieldy masses of information that goes into **combinatorial problems**, all of which I recognise as relevant to the context that I sketch out here. They identify the mental flexibility and creativity needed to juggle **formal tasks, maintenance tasks and compensation tasks** needed to achieve conflicting goals. These support in particular the 'way of working' section in my work as well as confirming the challenges of working at this level.

Cegarra (2008) suggests that one should allow schedulers to be responsible for balancing objectives and help/support them in managing the trade-offs inherent in achieving this, which again resonates with my motivations for and achievement of the 'ways of working' section, particularly the parts with respect to the 'T structure' and the supportive stance that can be established by a balanced COC approach.

De Shoo et al. (2011) build on this theme by asserting that the quality of the scheduling decision making is more important than the decision itself. This resonates with the need for an MFT approach to key decisions and the sign off process to be encouraged at the end of a significant piece of planning or re-planning, where I would recognise that a perfectly prepared plan *without* stakeholder buy-in is all but useless.

Sin Oih Yu et al. (2010) draw attention to the benefits of perspective that can be gained in highly complex launch environments (similar to my own context) by focusing on a simple higher level aggregate resource model as a way of establishing useful numbers by which to navigate. They reference data from three Brazilian companies encompassing Aircraft manufacture (Embraer), food processing (Sadia) and bicycles (Caloi), and use an analytical model to put a

value to complexity that recognises that 'the complexity of development projects is determined mainly by the characteristics of the industrial segment'. They go on to reference Hobday (1998) as a source of useful metrics when considering complexity.

Hobday (1998) has an approach to classifying complexity based on the **number of components in a product, the level of technical innovation, the cost of the project, the diversity of knowledge domains and the intensity of customer involvement** that I would recognise as supportive of the view on complexity that I hold as practitioner. It also has strong parallels with my paper for Oxford and could well be read alongside my descriptions of how complexity accrues in an aircraft development programme. I refer to the number of parts, plants, systems and so on. This also acts well as a complementary text to the four sources of complexity pointed out by Rimmington and Pollack (2007) referenced in section 4.4 **(structural, technical, directional and temporal)** and is recommended on this basis. Hobday also refers to high cost complex products and systems as CoPS and recognises that the disbanding of project teams at project completion hinders or has negative implications for product and organisational learning in general, which is supportive of my claim that many PMOs with a one-project view lack the perspective to make calls based on accumulated prior learning.

Xia and Chan (2012) offer a range of complexity contributors that other planning practitioners may recognise or find useful, drawing upon studies in the Chinese building industry; they offer **structure and function, construction method, schedule urgency, project size and scale, geological condition and neighbouring environment** as having a measurable impact on project complexity.

Thome et al. (2014) build on the theme of defining complexity with some additional measures and definitions of complexity that could help practitioners in the field to think about the subject. They offer **interconnectedness** and **unpredictability** to the list of contributory factors and suggest other sources for those seeking to define complexity more fully. One of their conclusions is that the adoption and effective use of sales and operations planning (a form of integration of planning data at top level) should be a priority for manufacturers with complex products or manufacturing technologies.

Xiaowei et al. (2012) add to this understanding by discussing two types of production complexity encountered at a workstation: **feed complexity** caused by the features of the current stage of the build process, and **transfer complexity** caused by events prior to the current workstation. Key here is their assertion that transfer complexity can only flow one way in a system (that is to say, downwards towards delivery) and this, plus what they point to as the sometimes exponential nature of this downstream flow and accrual, is what can lead to so many scheduling difficulties towards the end of a large project.

Walton (2014) offers an excellent overview on how complex systems may be 'nested' and interconnected from an organisational perspective and discusses how with a non-linear response to change inherent in a complex system, a change in one area may produce a negligible change in another area or a large scale impact: the complexity itself drives an uncertainty in response that makes it difficult sometimes to pin down the effectiveness of impact studies in a complex arena. He uses schools as an example, but references other useful healthcare, medical and educational studies.

Blomme and Bornebroek-Telintelo (2012) describe purpose in life as based on creativity, experience and mind-set, before going on to discuss managers who create a work environment for themselves (which I think I do), which they then react to in their own corner of complex systems (my corner is scheduling). This paper also makes the connection to the meaning-making and interpretive role that I set myself and others, and go on to react to with my own ways of working, tools and knowledge and evaluation.

Gaudreault et al. (2011) draw conclusions from the lumber industry on the benefits of combining process planning and scheduling roles into what they term 'integrated planning and scheduling' to address complexity as they meet it. They state the aim as optimising a single model to decide on what, when and how to deal with the resources. I recognise this as having parallels with the approach that I have adopted, albeit in a very different industrial setting to their largely manually scheduled.

Key deficit themes in the existing literature – a summary

Similar technical journal searches on **integrated planning** specifically, rather than on complexity, yield a similar pattern of returns. There are papers on taking integration action between departments, such as integrating process planning and production planning, and control in a cellular manufacturing setting (Zadeh et al., 2014), with articles at a single disciplinary transactional level (such as how to integrate MRP with capacity planning (Taal & Wortmann, 1997) that treat topics in isolation so that they can be understood. However, I would suggest that where the literature falls short here is in describing the practical link between length of experience at a level in scheduling influential enough to have impact. In addition there is an absence of conceptualisation of the practice of a senior planner from the practitioner perspective. I have found writings on transdisciplinarity to come closest to conceptualising my kind of practice and practice context, and as a template for resolving issues together; as an articulation of the expertise required in the role, tailored to fit with the complexity of a major transnational product suite; the knowledge that this can nurture; and the tools that this can unlock (see conclusion below). This is the area that I cover in some detail with practical examples (see below).

Dixit et al. (2014) point to complex products such as ships and aircraft that experience as particular test uncertain durations and lead times, such as when it comes to aligning procurement plans with WBS-based project plans to help optimise stock and inventory levels. This is a useful perspective as it helps to establish the context of complexity inherent in long duration uncertain projects. It then moves off into a discourse on algorithms and formulae rather than moving towards ways of thinking about complexity that might bring forth ways of working, knowledge or management tools. Kim and Lee (2013) follow a similar route to describing how complex IT tools can be deployed in complex scheduling situations to model and simulate the situation as it is encountered, using the inherent complexity as a component of the answer. At this stage I point to simplicity as a potential antidote to complexity from a planning standpoint.

Conclusion

There are many articles available that help in illuminating *aspects* of the framework against which the level of planning I describe takes place. Tools for sharing project management outcomes, for example, have been well summarised, but the literature gaps are clear to me. They are, on the whole, in the 'discussion of an event-only' view (one project, rather than multiple and overlapping) and in the segregation of the planning role into discrete tasks rather than as an integrated centre of competence approach. If information is taken separately from the existing articles/journals, papers and books, none of it in itself is adequate to shed light on master scheduling in a complex environment, which requires something more than integration at an instrumental/transactional level. I have been motivated to devote the considerable time that I have to this articulation of my work and outputs, precisely to give insight into and ways of thinking about master planning in complex environments.

While the existing texts on complexity and integrated planning can help fill in pieces of the mosaic, none quite cover how the pieces fit together, and what the material is that holds them together yet is flexible enough to allow for shifts and adaptation to changing internal and external environments. In my reflection upon experience over time, ways of working need to be supported by ways of thinking and facilitating, which in turn inform and enhance ways of working. In this work I describe the accretive and incremental nature of progress towards this practice. I am aware that subjective influences also influence professional attitudes and ways of doing and being, but I believe if we have enough contributions from senior practitioners combined with extensive experience, some commonalities, insights and ways forward may emerge that can address the current gaps in the literature. In my explorations I have been particularly struck by how discourses on transdisciplinarity can assist the articulation of both complex practices across disciplines and the relevance of the thinking for an increasingly complex world of overlaps and interdependencies.

I have come to feel comfortable with using the term 'transdisciplinary', as it captures for me the complexity of the role I have and what my goals are in that role. This was my first challenge, to articulate the nature of my role. I sought out various terms to help me describe it – multidisciplinary, plurality and

interdisciplinarity – and eventually to the discourses on transdisciplinarity that attempt to move actions and knowledge beyond discipline boundaries. It came to prominence as a way to approach the 'wicked' or 'sticky' problems that affect many stakeholders, such as climate change, through the bringing together of different disciplines open to being changed by the shared knowledge of others. I find Ramadier's definition resonates most with what I believe I do:

> Transdisciplinarity essentially concerns the articulation between disciplines, rather than their relations, as is the case with pluri- and interdisciplinarity. In other words, the specificity of transdisciplinarity is that it simultaneously integrates two contradictory movements of disciplinary thinking: on the one hand, the compartmentalization of knowledge; on the other hand, the existence of relationships between the disciplines – the aim being to determine how the different forms of knowledge thus produced can be articulated together. (Ramadier, 2004)

Additionally, Pohl (2011) defines transdisciplinary research as framing, analysing and processing issues such that complexity is fully grasped. He includes that the diverse perspectives on an issue are appreciated (what I would see as shifting ones ontological response), that abstract and case-specific knowledge are linked (as in the learning curve section of this work) and that a 'common good' language is used in relation to any outcomes.

There are many individuals in other industries that have a similar profile to mine, and these are the people who could be encouraged to write at this level to address current gaps. They might face similar challenges to myself, not least in translating the layers of complexity in complex, high-value manufacturing, where mistakes can lead to impact on a large scale. However, these are individuals who have the advantage of seeing a product through to completion over the number of years it takes to produce it. Looking again at Schön's call for a new epistemology (Schön, 1995) in the articulation of professional practice, his way of achieving this through a process of reflection-on-action and reflection-in-action is what I have found most useful. It has moved me from spreadsheets and numbers to an increase in the quality of my awareness and to encouraging others to stand back constantly to take in the bigger picture.

Where the current literature of my field falls short, then, and where this work is an invitation for other practitioners to go on and expand on this research, is in the specific area of practical considerations. These are considerations of how to meet complex and large-scale scheduling demands through recognition of the planner's role as transdisciplinary, facilitating the articulation between different ways of thinking and doing by different stakeholders to arrive, first at an understanding of each other, and secondly at a consensus on ways of working. Such ways of navigating complexity need to be appropriately supported by the leadership of transnational manufacturing operations. In my work and what sits behind many of my outputs are ways to promote collaboration between partners, colleagues and stakeholders. These are also designed to help sustain trust in each other and in our systems. Writing on the importance of trust in collaboration, particularly transdisciplinary collaboration, Harris and Lyon (2013) have this to say:

> Trust is an expectation of others in a relationship. It occurs when there is an element of vulnerability and provides confidence in others even when there is a risk they will act opportunistically (Nooteboom, 1999). In terms of understanding collaborative research, there is a need to explore how trust is built up. Zucker (1986: 60–65) has set out three 'central modes of trust production'. In addition to institutional-based trust (such as contracts or rules related to shared expectations from formal structures), she also refers to process-based, where trust is tied to past or expected exchange such as in reputation and gift exchange; and Characteristic-based, where trust is tied to a person, depending on characteristics such as family background or ethnicity. Trust can also emerge from existing control measures such as formal contracts (Klein Woolthuis et al., 2005) or start with a 'leap of faith' (Mollering, 2006). (Harris & Lyon, 2013)

Of key importance to my work is letting people know that they can trust me and my decisions. This comes from my providing the conditions for trust to be present by being fully aware of institutional-based trust – I can be trusted to know all the rules and regulations, process-based trust – as I have built up a reputation over time of reliability and of devising ways that will help others to navigate planning as part of my professional role. Moreover, there is characteristic-based trust – people trust me because I am open to difference and can converse with people on many levels, demonstrating my human traits and attributes such as loving football, painting, being from a local community and working-class roots.

Finally, Cunha et al. (2010) recognise that it is not possible to understand organisational complexity without considering the role of simplicity. They pose the question quite boldly: 'what if only simplicity could cope with complexity?' They recommend deciding where the information is and letting the swarm decide, rather than top down as in traditional or hierarchical models. This is very much in line with my view of keeping planning simple, setting up a supportive structure and letting planners decide locally rather than waiting for a top-down response. Cunha et al. describe this as a simple infrastructure supportive of adaptive local swarm behaviour, with simple job rules and descriptions as a basis for countering complexity: which is what I have set out to do.

The search that I have performed cannot, by its nature, be conclusive. What I have aimed for is an attempt to bring out the most useful material for other interested practitioners and to point towards keyword searches and sources that are appropriate to literature reflective of the current body of knowledge in this field.

1.3 Self as part of context – values and motivations

Personal epistemology based on critical exploration of self.

My own professional epistemology centres on making reflective and practical sense of how to create and sustain conditions helpful for effective planning in complex (and occasionally chaotic) situations of mass data and challenge. I am as a person and in my professional role a pragmatist. Planning is about pragmatism. I appreciate the world is made of facts, figures and constructed meaning making and realities. There are means and ends, and my view is what means to use to what ends fit both my values and the responsibilities expected of me in my professional role. I had always considered pragmatism to be about a practical approach to realities, and intuition to be innate and inexplicable, but a simple view from Pattison suggests that intuition is like a personal datum where you and the world meet, and where 'the meaning of a situation, an event or text is the articulation, the clarification, the laying bare of that which we project on it: i.e. What we see in it' (Pattison, 2000: 110).

I now see the environment that I set for planners as an appreciative oasis in an often turbulent manufacturing and project arena. This allows people to give their best and enjoy it. It leads to high engagement scores supported by appreciative enquiry: what Cooperrider and Whitney (2005: 65) call 'permission to be positive' as a starting position and by establishing a micro-climate of support on key issues. I also now understand that what I originally rationalised (if I thought about it at all) as natural/common sense, with respect to my focus on development of the team and close attention to recruitment and coaching, could in fact be interpreted as essential professional nest-building rituals that help maintain a professional community of practice.

At the start of this piece of research, I remained confined to a job/role/ sector-bound view and I would have described complexity as something that can be either exhausting or invigorating, depending upon one's place in it and response to it. In panning back a little through reading, writing, reflecting and through conversations with my academic supervisor, the next layer was revealed. I can now see my place in complexity as fully embedded in it and invigorated by it. Some of my approaches to management of complexity through embracing it and offering alternatives to it no longer appear role- or sector-bound, but would appear to have relevance to the management of the four types of complexity that Rimington and Pollack (2007: 89) identify as structural, technical, directional and temporal, in organisational settings wider than my own. I am interested in the notion of navigating complexity (Maguire, 2015) rather than 'managing' it, as it is in the complicated interactions between the various perspectives that my engagement has peaked.

I feel better equipped now to reflect upon my own practice and better able to frame for myself the (literature-led) academic basis for the way that I act to transform and translate data into knowledge, at the same time as acting as an appreciative interpreter. I see now that I act in both directions with respect to being sent into bat for the planning team with what I ask for as 'winnable arguments', and return from higher level reviews with appreciatively interpreted challenges back to the team. So, in a real sense, I act for and speak for two sets of teams (my team of planners and the teams 'above' us in the power network), as well as acting as an advocate in both directions.

This requires tools, techniques and ways of working, and I have selected public works to illustrate the process. But a key learning for me has been on how what I have learned about why this works has become more relevant than the dry detail of how. I now understand for example why showing a strong interest in developing and maintaining the conditions for peoples' development is important to the tone we set for a planning group and how that in turn links well with acting as the 'external' representative of the group, as a conduit, a metonym, and seeing my role more clearly as a translator accessing a variety of hermeneutic tools such as humour/metaphor and art to bring the subject alive and frame it for others: what Pattison writing on Heidegger (2000) calls an 'accentuating articulation' (p95). I can see the axis of conflict between addressing misconceptions without judging within the team and yet reaching for the pen and promoting understanding through controlling the message (exerting bias) outside of the team.

My notion of understanding of the transferability of my reflections between different boxes/disciplines/areas has grown, as has my personal understanding of how I elect to view time and temporality in so far as they shape my professional responses to situations and the way that I exercise leadership. I have always viewed the privilege of leading people is as an opportunity to remove obstacles so that they can enjoy and be creative in a role in the full knowledge of support when they need it coupled with clear direction on what is expected from them.

This research has helped me rationalise my professional learning (product/tools and so on) and distinguish it from my purely personal learning (social/practical etc.) My critical engagement through this process then has grown from dry facts, through un-reflected narrative, to a body of work enlivened by appropriate reading/writing and reflection that built from non- accumulative (individual critical points) to a fully accretive set of themes from which I have been able to distil the primary learning points for me. This in essence, was the learning goal attained for me.

The hope is that these reflections prove helpful to other practitioners facing similar challenges or learning goals, capturing good practice for others to take forward in the future – a kind of succession manual. I have come to believe that

it is necessary to articulate one's expertise in order for it to be shared and understood by other developing or would-be planners.

As mentioned previously, one of my challenges to myself is succession. How can expertise in an area be passed on, and how can practices be separated from those who have designed them and invested much of their values and personality into shaping them? In other words, I feel it is my responsibility as a leader to ensure that the practices are sustainable without the agent. I believe my appreciative and collaborative approach and my commitment to recruitment and training, and now the development of this critical statement, have been strategies to ensure that good practice is passed on in such a way that it is not the passing on of a tradition, but of a way of responding to complexity that will always be in a state of development.

As part of my own process I began to explore what values and motivations I brought into my professional role and how they shaped the practices. I started with some basic questions on my values: the most formative influences; have I always been motivated to learn; what critical incident set me on this path; how I know what I know; the difference between being professional and being a professional; what makes me good at my job; and the difference between doing and being in the world?

I am, and always have been, an avid reader of everything from newspapers to novels, from web news on a mobile phone to poetry, to the back of a cornflake packet at breakfast. I remember a complaint from one of the teachers at primary school in Liverpool when I was about 6-years-old that 'Philip always has his head in a book'.

I have also always had an inbuilt inclination towards art, particularly paintings. I won small prizes and local recognition for paintings at school, and continue to paint landscapes in oils for recreation **(see Appendix 2).** I have exhibited and enjoyed financial recognition of my work. Not surprisingly then, my earliest recognitions of achievement fall evenly across reading (excessively) and expression through art. In reading I soon developed the ability to 'speed read' distilling information as I did so. The ability to hone down a text to its key essentials peaked during exam revision periods, when I practised the art of condensing key

passages to key words as a vehicle to knowledge retention and its timely re-use. This is a skill that I still put to use today. I feel very comfortable with mass data and can scan/filter and pattern-read quite quickly. I am also very comfortable with the 'Goldilocks' principle in respect of the amount of information required to draw an actionable conclusion.

Aircraft manufacturing, by its nature, generates a tremendous volume of information. We talk about kilometres of cabling, millions of fasteners and hundreds of thousands of parts, for example. Anyone with what Belbin might call a 'be perfect' mind-set might be drawn towards trying to understand all or most of this information. They would inevitably become swamped into inaction by the sheer scale and complexity that the raw numbers present. The ability to cut through this and simplify the information into trends and summary level material is fundamental to being able to deliver effective planning leadership in an organisation of this scale and complexity. This theme formed the core of a lecture that I prepared and delivered to Saïd Business School at the University of Oxford **(see Public works, section 4.4).**

In practice, this means being comfortable with neither too much information nor too little on which to base conclusions and recommendations for action. Too much data and analysis can lead to procrastination and delay, a symptom we might recognise as analysis to the point of paralysis. This would be where more and more data are accessed and analysed, at the expense of taking action or making a decision. If there is too little information ahead of a key call, the danger is action based on little more than opinion and the output is closer to an educated guess. This can have disastrous consequences in a high-value industry.

It is perhaps best illustrated by stock market investing. To run all of the analyst toolkit over a potential purchase every time would be beyond the scope of most private investors, so a compromise has to be struck between the amount of information required to produce meaningful analysis and the need to take an actionable decision. For some, it would require a very detailed trawl of company reports and accounts, directors' dealings, profit and loss, discounted cash flow for future earnings, and so on. For others, a name they recognise (such as Marks & Spencer) plus a projected dividend yield is enough to persuade them to buy. My Goldilocks version, here, would be to look at five years' profit/debt/dividend

history followed by a current P/E and dividend cover check and I would feel good to make a decision. Having done so, I would cross-check it for sense against my long-run frame of reference, such as whether the decision sits comfortably with my own view of demographics (an ageing western population, for example) So, I would circle in on a micro-level decision based on just the right amount of data, cross-check the answer for sense at a macro-level, then proceed. Having invested, a review of progress would need to look past all the short-term noise and daily price swings to pick out long-run trends as confirmation to stay invested.

I see the influence of my ability to draw and paint in my professional make-up today in everything from my career choice to my personal impact. The critical series of linked events that took me in the direction that I have followed for a good portion of my career began with applying to use my artistic skills as a designer. I joined Hawker Siddeley Aviation Company to draw. As my apprenticeship progressed, the constrained nature of the design team roles at that time became clear to me, and the opportunity to draw plans, programmes and schedules emerged as an alternative. I had a short secondment to the planning team as part of the role rotation process, was hooked in and learned quickly.

A colour-coded annual production plan of aircraft phases undergoing construction is actually a form of industrial art, if framed in a different, purely visual context. But it also distils and conveys masses of data in an elegant and efficient way (**see Appendix 1** for a screen-shot from a typical representation of a master production schedule). The pattern reader in me is comfortable with the information coded in the picture; the artist appreciates the grace and simplicity; and the data distiller appreciates the mass of words that would have been needed if the plan had been in text form.

A career in planning brought together my earliest 'success' strings into one bow. Building upon this are what I value. I can tell the difference between **busy and effective**. It first hit me in stark relief at my daughter's school awards evening where they had two classes of award for each category. There would be an award for effort in maths and an award for achievement in maths. The award for achievement meant a certificate, a pass, in other words a result. The effort

award went to someone who had been busy, trying to improve, giving it a go, but not quite delivering an otherwise tangible output. I knew then, and I know now, which I value the highest. This outlook flavours how I read a much standard communications, as I have always been happiest with results (we've built 10 aeroplanes) rather than effort (we've had 5 meetings and spent 500 hours agreeing how we might build an aeroplane).

I was also tutored by a member of one of the first departments that I joined many years ago in the first company that I worked for on how to look busy. This consisted of: turn up on time, keep a pen in your hand and a ruler on the page in front of you, and if you must 'rest your eyes', do it with your head down and do not snore! This obtuse point leads me into the fact that in many companies there can be a lot of confusion between effort (in at 6:30am, last to go at 8pm) and results (reports completed on time, 5 products shipped early). It is also clear that in operational learning environments at least, a loud, extrovert 'firefighter' busily putting in visibly heroic effort will often be rewarded ahead of quieter routine achievers. I do also acknowledge, however, that being excessively busy can also be a result of lack of planning that, in turn can show up as an impact in a lack of effectiveness as measured by results.

Striking the right balance between **conforming**, being busy, putting in visible effort and achieving in line with core personal principles is a tricky set of trade-offs. And I know that I do not always achieve the right balance on this all of the time, due to my stubborn streak and conviction view of events (more on this aspect shortly). But a degree of balance is essential to delivering on the role, securing professional recognition and earning the right to be heard. In an ideal working environment, I would prefer to be judged on, indeed, I judge myself on, results in all the categories in which I am responsible or play a core role. But I do not like conforming, and clocking in and out makes me feel like a battery hen. I know it is a prerequisite in a large industrial complex, and I know that we all need to be treated alike in this regard, but the practice runs contrary to my core value set by measuring the effort, not the result. I avoided clocking on and off for as long as I could by putting through mass corrections to my attendance file until it became obvious even to me that it would be easier to clock than not.

This is beginning now to get towards the heart of how I see myself and the value choices that I make in conducting business and searching for impact. When I was younger I always had a strong sense of being awkward, argumentative, self-willed and obstinate. I would ask testing questions. I always wanted to understand why something needed to be done, or had occurred. I wanted the information to help me make my own mind up. I was aware that this could be perceived as stubborn, but I was not concerned by the label. I quite like being of my own mould.

Conforming to the crowd is quite a conditional process for me, then. I know a degree of conformity is needed to ease the daily process (clocking) and I understand the need for routine data (such as production volumes) to be always correct, to earn the right to critique progress. But given that I value results, not effort, I do find this a value clash that drives anxiety. For example, I do not memorise production volumes or delivery dates, and need to mask this because it is not unreasonable to expect a planning manager to know what units are due for delivery next week, yet that is not the sort of information that I carry around with me in my head! How I manage this dilemma is, as I said, conditional. Like most of us, I have an internal rule set that plays out on this.

Again, I will use a non-work situation to illustrate. At football matches (I follow Liverpool), the crowd chants songs throughout big games. It is part of the ritual of sport at a top level. I have a strong value set that avoids foul language at home and at work, and instinctively I embrace positive sentiment and avoid negative and destructive themes. So I choose. Not really consciously, but subconsciously, irrespective of the number of people around me, I will choose to join in with celebratory songs and songs with words that a child could hear. But I will pass on the derogatory, negative and abusive chants, not through a sense of prudishness or to put myself at a distance to those around me, but quietly as an act of faith with my inner values. I do not judge those around me for their choice to sing, and I do not expect to be judged on mine not to.

Sometimes, in the same context, I am confronted with another test of values for me that is akin to the clocking in and out dilemma. This is the crowd mosaic. Before the start of a big game all the seats have a large piece of coloured card placed on them. The expectation is that on a given signal they are all held aloft

at the same time to portray a statement or picture. This is the need to conform to a mass response again, where it is not as easy to opt out as it is with chanting. The value that this tests in me is my individuality versus the greater mass, and if only for a moment or two the urge to assert my individuality does rear its head. In the absence of any excuse here, I will tend to conform…. Grudgingly, as, along with clocking at work, the risk or potential discomfort from non-conformance is higher than from conforming.

We all have a sense of ego and I feel that quite as keenly as others. I manage the trade-offs that work and that life throws at this by weighing them against deeply held values. This builds on what I understand about myself, where I would recognise that I have a strong sense of 'self' coupled with a degree of contrarianism in my instinctive response to situations, which I am content with.

Building upon these fundamentals is the issue of **conviction**.

I experience this as an instinctive response to another individual and would trace my awareness of this back to high school. At school in the mid1970s I was taught by what would probably be recognised as a normal range of teachers. What I mean by this is that if we scored their attributes and pupil impact in a way that could be graphed and compared, then they would have formed a loose sort of normal distribution curve. This would show some poor and disinterested teachers in the left-hand (negative) tail of the bell curve distribution and the bulk of the 'OK' teachers in the main body of the distribution. However, there would be one or two in the right-hand (positive) tail of the distribution. Those on the right-hand side had the biggest impact on me. The convictions that they held and conveyed is the primary reason why. This is true, irrespective of the subject matter that they taught: conviction transcended content.

My English literature teacher had the dubious pleasure of conveying the mysteries of syntax and narrative form to a class of around 25 pre-GCSE teenagers, and I was one of his pupils. The best way that I can briefly describe how his conviction in the subject connected with me is as follows. He came alive with the subject, not in a staged way or a theatrical way, but in a genuine, enlivening way. He communicated with you not the dry data of sentence construction or the use of syntax, but the exciting essence of the message and

the perfectly apt choice of the words as a medium for conveying them, and why. What he said 'rang true' in his first delivery, and in his patient and considerate response to any questions that came along. There were no inconsistencies in his message and he was not acting or going through the motions of delivering a syllabus in which he had no interest. It was clear on every measure that he believed what he was saying, and could convey it with an unforced passion. I remember that early role model's name still forty years on, when I cannot remember most of my class-mates names! I am binary on this subject, very black and white in the way that I listen to others and the way in which I convey things.

In a politician, or anyone conveying information to me, I look for this same level of conviction above all else. I do not want a politician managing their backbenchers and the press through saying the right thing to me. I want to know that they believe this path is correct because they believe it. It is also important to me that they explain why they believe it, as this would allow me the chance to connect with the explanation as well. This conviction response in me carries everything else ahead of it. They can even be wrong, but conviction will always draw me in to listen closely to what is being said. I can even applaud conviction when it is wrong or dangerous, whereas pure acting and political positioning, even if it is safe and right, will leave me cold. So, I like conviction from people. It is a trait that I admire. What it means to me is: tell it how it is and believe in what you are saying, not as a route to convincing others but as the starting point.

In my mind, this is linked to confidence: an air derived from a clear conviction, backed by a mastery of underlying facts and information. This is what Lynch and Kordis (1988) call 'knowing what your purpose is and honouring your deepest values' (p114). I know that I carry this belief system into my work life, and try to live by the same approach. On reflection, this may be behind why I am asked to do independent dip checks on a controversial product area, red reports on progress risks or process audits on other parts of the aeroplane. I will either believe in something and will confidently put it across that way, or will declare that I do not but am delivering a party line, and the reason that I feel obliged to do so. If I am then asked for my professional opinion on the subject being discussed, I will give

it in my own words. So I will answer honestly. This is another example of me living by and respecting another core value.

I do recognise that this is situational and can be received well by my own team and peer group, but may not have the same warm reception everywhere. I would say that my conviction approach is an externally recognised trait. This has been put to use in deploying me as an honest broker in certain circumstances where this would be an advantage, for example, with trades union representatives, in presenting a planning view. All sides know that I will only table and explain the data as it is and as I see it, and that I cannot manipulate it or be manipulated.

I do recognise that inappropriately held and inflexible conviction can have deeply worrying negative consequences, but I am clear in my interpretation of the positive aspects of the clarity that comes with simply offered belief. So, in my own interpretation of these circumstances, conviction is equated in a work setting with trustworthiness: 'what you see is what you get'. What I know, but is less obvious to others, perhaps, is that I embrace conviction for two reasons. The first is because of my own instinctive response to it in others, and the second is that as an individual with more introvert than extrovert traits, I cannot pretend, even if I wanted to. Therefore, in reality, I have a choice of believing in something and conveying it with conviction, or remaining silent. The opportunity to 'busk it' or bluff, or toe a party line that I do not believe in are denied me, and as a consequence I would never make a good bank robber or financial fraudster. So, I appreciate conviction and I see the opportunity to tell it as it is, as trustworthy and helpful, and I cannot act or carry a lie.

Finally, I have an inbuilt bias towards doing what I say I will do. That means that if I have promised an output for Tuesday next week, then there will be an output from me on Tuesday next week. This **reliability** that I guard tenaciously is not virtue for its own sake: it has a very strong practical edge and is part of how I see myself acting professionally as a 'trusted worker' (Freidson 2004: 151), rather than just as a professional practitioner.

It is also a key attribute towards earning **autonomy**. If people know that you will do what you say you will, you tend to be spared all the interim meetings

checking on progress and calls to see if it is done yet. Reliability earns the right to self-manage your own workload, and I react badly to people who do not recognise this in me and want to micro manage me (infrequent) or to those delivering to me who lack the trait and force me by their inattention to reliability to manage them more closely. I see this as one of the building blocks of being a professional. It also helps in earning **appreciation**.

Appreciation works for me by reinforcing my confidence to assert myself, to be heard. Building on my natural response to positive interaction in a sporting setting discussed earlier, I warm instinctively to Cooperrider and Whitney's (2005: 61) definition of organisations as 'centres of human relatedness, first and foremost, and relationships thrive where there is an appreciative eye – when people see the best in one another…'

I am not sure that relying on others in an organisation to be naturally positive in outlook is a secure basis for proceeding. In the absence of cultural embrace of the underlying principle behind appreciative inquiry at the corporate level, my own learning leads me to conclude that an 'appreciative eye' has to be earned at an individual or micro-organisational level. The cornerstones of how to earn an appreciative environment will vary by person, by role, by organisation and by many other factors. For me, this route can be charted by strong previous and current results, the right amount of perceived effort, strong results and enough conforming to 'fit in' and enough conviction to be engaging.

The alternative to this would be a deficit-based approach to issues where the organisation looks to problems and gaps rather than opportunities and strengths, an environment in which I would not feel as free to comment as in an appreciative one. Therefore, I actively seek the climate that suits me best, by ensuring my track record conserves and nourishes future appreciative responses that give me the opportunity to act with autonomy, and I encourage others to do the same.

With respect to how I view doing or being in the world, I assess the difference as the footprints I leave behind. From my children to oil paintings, to a hand in someone else's development or their selection into a role, I derive deep satisfaction from the opportunity to support direct entry graduates and others

prepared to learn, and I am enthused by the role of recruiter, mentor, supporter and coach.

I would claim that the personal impact I have had and still enjoy is the range and reach that my thoughts have had. I am pleased to see the adoption of techniques and tools deployed here to solve one set of issues locally, and being appreciated and deployed in other European plants. Further satisfaction is derived from seeing theory that I have worked up and tested being deployed and put into practice in plants as far away as China or USA.

How do I know what I know? I reflect on each experience, the good and the bad. I treat life, the job – each challenge as a chance to learn and continue learning. And I tend to frame my learning in context, as part of a career perspective and a life view rather than taking events in isolation. I have always asked, or sought to understand why something occurs, not at an obsessional level but as a natural trait. I compare views with others frequently, daily even, testing ideas with peers, people outside the plant in other factories and other industries, and in books or journal articles. I welcome a wide frame of reference to test options against and take feedback from. Finally, I share what I have learned quite freely. I am not guarded about it at all, and the process of putting what I know into words forces me to structure my learning and record it for use. It has the side-effect of reinforcing and strengthening the knowledge for me, too.

So what do I think makes me good at it? I should like to think that what people are looking for from me when they seek my input in a work setting is a mix of all the above! I also think that the agility to be able to convey a clear message in written, oral or picture form is helpful as well. I think I act professionally enough to show strength in a crisis and act calmly enough to set a positive and appreciative climate for my team and those around me. I embrace the simple philosophy put forward by Arthur Ransome (1980: 181-184) about changing the weather where it does not suit you. He talks about fishing under a bridge if it is raining or at dusk if the sun is too hot as a route to enjoying fishing more productively. He is describing a process of identifying the greatest common unfavourable factor (GCUF) and changing it. In a work setting, this can mean providing calm, quiet and effective support for team members who are daily

exposed to loud, confusing and sometimes unappreciative environments. I effectively support them in changing the 'weather'.

My career perspective allows me to recognise situations as 'similar to' and do what Schön (1983: 137) refers to as 'bringing past experience to bear on a unique situation'.

My career long and linked view of multiple product launches, new plans, recovery plans, down turns and ramp ups allows me to draw upon reliable data from multiple experiences. This is in contrast with others who may only have a single product, single perspective view of a process, and lack the record keeping ability or opportunity to register the key learned points for them.

This means that like an angler viewing a brand new stretch of river for the first time, I can bring experience to bear in first of all framing the problem (where might the trout lie in this piece of water) to identifying the features that I recognise as similar to a more familiar piece of water that I have fished before (a rock over there, a fast current over here) and begin the process of what Schön (1983) calls reflection in action to identify where to cast the fly. The confidence to say no is also something that I and others appear to value. Knowing when to draw a line in the sand, explain it and stick to it on both points of both principle and points of fact. I think my peers see this as an expression of passion and sincerity at times, where in my mind it is usually just logical and sound.

I do recognise a uniqueness in the way in which I organise the planning task and use structure, continuous improvement, supportive and appreciative framing to set an engaging workplace. This has been recognised outside the team and I am working to share this approach by demonstration and by short papers.

I see this doctoral submission as the vehicle for me to understand this at a deeper level, and as an opportunity to link all these separate and competing strands together in a framework of critical appraisal.

Chapter 2 Organisation and Themes

2.1 Organising the complexity of planning for this statement

This piece of work summarises and places context and structure around the public works that I have produced and used during the significant part of my career spent in the planning of aerospace products.

Role autonomy and seniority have afforded me the opportunity to research planning tools, trial different approaches to key scheduling phases and to process lead planning developments. This freedom to act, coupled with strong record keeping on key schedule data across many programmes encompassing several companies, has led to a unique opportunity to shape opinion and change planning and project management processes at the highest levels in a global business.

These substantial **contributions to knowledge and practice** have been on products in series and stable builds, products undergoing recovery from schedule abnormalities, and the launch of new or derivative products. I have drawn on examples from all three areas of interest, and most heavily from the arena of new/launching products and periods of planning sponsorship shifts, as these are the areas of greatest uncertainty and with the highest demonstrable impact.

I have selected from a range of examples in the supply chain at key suppliers, at Wing major component (MCA) level, and at fuselage and final assembly line (FAL) level. What I present here is a career perspective on planning in an industry often dominated by an event-only view. This brings with it the opportunity to capture knowledge on what key data is worth retaining as a guide to future planning, and the response to this data that can be influenced by how and when it is presented.

2.2 Theme selection

As the central thrust of this body of work centres on managing complexity through mastering knowledge capture, ways of working and tools/techniques; it provides the opportunity to sum up the central claims under these headings.

Then I go on to set them in context against the phases of a launch plan where they are most likely to arise. The method I will use to place these works in a frame will be to review the various phases of activity and then show the combination of knowledge, way of working and tools deployed, referencing the appendices where these themes are expanded on further.

These reflections have the potential to enrich the body of knowledge in this field, as most individuals' role perspective on this has the benefit of only one or two launch cycles at best, and some only see a limited perspective for part of the five to seven years it takes to deliver an aeroplane from TLR to market (Robinson, 2014: 14-17). I have the data and can discuss outcomes from five product launches and nine major derivatives over a period approaching forty years (see Figure 1).

For **ways of working** I have referenced back and forth between organising for series in a plant of several thousand employees and responding to the specific requirements of planning for product launches. This has allowed me to consolidate my learning about changes required to skills at various stages, attrition expectations, general engagement and similar themes. Evidence to this effect is included in the relevant **Public Works, section 4.1.**

Under **knowledge retention and sharing**, I have selected some of the prominent material that has helped me to deliver impact through defining opinion and shaping everything from underlying rate assumptions and capital (cycle times) to labour employment levels in the thousands, affecting grant aid and UCOP (staffing hours) as well as likely compression and lead-time behaviour that has informed the risk to the overall schedule. Major sub-categories have been confined to cycle time/compression behaviour, and I have referenced a redacted generic suite of cycle time summary material in this submission in order to draw out general themes and personal learning. This forms the body of **Public Works, section 4.2.**

For the **tools and techniques** element, I have pointed to the phases of the programme in which they have proved most applicable and mapped these on a timeline overlaying the standard generic launch PDP methodology. I have then gone on to discuss personal epistemology in light of the favourable (and

unfavourable) responses received. The evidence under this theme is presented in **Public Works, section 4.3.**

My current role as **Head of Plant Scheduling and Planning - Wing** allows me to link an overview of lessons learned from previous product launch data, key trend capture and analysis, to the expected outcomes from subsequent launch predictions. I also sponsor the maturing of model of organisation and leadership that sets an appropriate framework for knowledge retention and deployment, along with the communication of a clear perspective on ways of working and how to cope with schedule complexity by the appropriately timed use of key reporting and visibility tools. Organisational impact and reach are fully secured in this way.

Personal development and links to academic/taught learning have been demonstrated through documented membership of and contribution to universities, as well as key roles in Airbus-level committees. The impact of my work and its contribution to professional practice within Airbus is secured through papers presented on cardinal rules and how to deploy them, as well as planning papers on mission and purpose, leading to key tasks and role positioning in the wider organisation. Impact in the wider industrial/planning community is demonstrable through my membership of and contribution to the Airbus planning council, my role as assessor at development centres for programme managers, chairmanship of accreditation panels for project managers and leadership of interview panels for direct-entry graduates. More widely, I draw knowledge from and can contribute knowledge to a wide external network including membership of a number of **professional societies** including the Chartered Institute of Logistics and Transport (CILT), the Chartered institute of Management (CIM) and the Association for Project Management (APM), where I hold a fellowship position. I also sit on the Industrial Liaison Board for Liverpool University and have delivered papers at **University of Oxford (Saïd Business School)** and at various plants across the Airbus network in Europe.

2.2.1 Philosophy

From a professional and personal perspective, the development that I have gained through this set of activities was lifted to a new level with the opportunity

to re-focus my professional development on the three main strands of P+PM accreditation, APM fellowship and the desire to consolidate this at a doctoral level. These three platforms have forced me to confront my learning to date, and to turn to and document the most significant and public works within them. This lends perspective to my next steps by seeking to build on what I have already done, while working on improving the process for delivering a planning and scheduling service that continues to adapt for the future.

Chapter 3 Complexity of Context

3.1 EADS and Airbus

3.1.1 Background

European Aerospace Company (EADS), renamed the Airbus Group, employs over 100,000 people in a global business engaged in a range of programmes embracing products as diverse as satellites, military helicopters and civil airliners. Around 14,000 of these employees are engaged in the UK business, which is where I am most active.

In common with many large companies, Airbus Group sponsors and encourages a systematic and controlled approach to programme managing new and major derivative projects. The **Airbus** (civil aircraft) part of the business is no different and adopts many of the practices and processes of the Airbus Group approach. This means deploying systems and processes along with a Project Management Organisation (PMO) to ensure a strong grasp of emerging programme management issues to a proven template.

The business is organised across multiple production facilities in Europe as follows. Manufacturing units (plants) where major aircraft sections are produced are located in:

Broughton	UK	Wings
St Nazaire	France	Fuselages

There are also manufacturing units where components are produced in:

Bremen	Germany	Flaps
Stade	Germany	Wing skin panels

There are FALs where the aircraft are assembled from these major aircraft sections and internally supplied components, as well as sections and components supplied in from a global supply chain:

Toulouse	France	Aircraft
Hamburg	Germany	Aircraft

Recent developments have seen a set of component and FAL facilities open in China, and plans are advancing for a similar set-up in the USA.

A planner's engagement with this network will vary considerably, depending upon the product being scheduled, as the mix of major sections or components supplied by manufacturing units or plants will vary by product type. This also determines the eventual FAL destination for final assembly. This is an outline context only and the detail behind this structure is expanded upon more fully in **Public Works, section 4.4**

3.2 Plant and product (series and new)

The programme management for **series aircraft** (those in current production) is managed through the plant organisation, whereas **new products** are managed by a central programmes team until a transfer to series gateway is attained.

Major derivative changes to existing platforms are a hybrid of the two approaches. This structure impacts on the way of working and who sponsors what data and so on, and it sets up creative tension as well as opportunities.

The balancing of roles and skills required to take an integrated approach to planning for combinations of new, series and derivative products is part of the contextual framework for this piece of work. The next part goes on to consider how a product matures from new to series by following a standard multi-company product development cycle.

3.3 Product development process (PDP)

For control of launching new products, most large manufacturing companies adopt a product development strategy based soundly on a number of key platforms. A full explanation covering cost, technical, schedule and political elements would be beyond the scope of this work, but I intend to draw on the elements that have the most impact from a scheduling and planning perspective. These are the areas with which I have had the most contact and have helped shape some of the tools, techniques and organisational responses outlined in this work.

It is here that I act as an insider–researcher, an active participant reflecting upon action.

Exerting planning influence in this area of a typical product life cycle feels like interacting with a combination of basic **Systems Engineering** logic punctuated by a milestone maturity gate driven project management methodology. Overlaying and supporting the principles enshrined in a Systems Engineering approach is a more formal milestone punctuation associated with the PDP. In Airbus this follows a gate review/milestone based project management approach developed as part of the 'Develop faster' module in the 'power 8' change programme.

The process is framed by maturity gates (MGs) and follows the standard approach, so that anyone trained in systems engineering would recognise the process, running from top-level requirements (TLRs) through to validation and verification. The key levers include managing maturity through a gate process, ensuring an integrated development plan, utilising the early involvement of suppliers, and encouraging the use of common processes and tools across a programme.

In this environment, the concept phase of a new product launch is defined as being prior to Maturity Gate 5, translated to 'pre-MG5', in PDP terminology. This phase is generally architect led in a central plateau where all the key contributory skills are brought together in a large multinational and multifunctional team. The definition phase follows (post-MG5), and is structured more around a component team-led organisation. Following this logic onwards would reveal a central team focused on integration as the development progresses, followed by validation and verification as the final, higher-numbered milestone gates come into view.

In outline, there is an evolution from Milestone Gate 3, or MG3, the start of the concept phase, through a series of milestones that capture significant confirmation steps in the design intent such as MG4.1 (aircraft performance freeze) through to MG5 and the end of the concept phase. Definition of the parts, systems and interactions then proceeds to MG7, where the definition is frozen and the start of parts production (cut metal) can begin. MG8 defines the

start of building large sub-assemblies such as a wing, followed by the start of Aircraft Final Assembly (FAL) at MG9. First flight, type certification and industrial delivery then follow in sequence.

As this process unfolds across a number of years on a super-value goods cycle such as an aeroplane development, the organisation responds with a variety of roles and structures focused on delivering on the product breakdown structure (PBS). Teams are centred on key areas of the product such as the wing or the fuselage, or the work breakdown structure (WBS), with roles in industrial management or configuration control.

Helping these teams to focus on key outcomes is an essential part of this process. These can include achieving what is known as design freeze at component level: a milestone that indicates that a team has successfully negotiated a balanced result through a whole series of complicated trade-offs. To agree on a freeze, the team will need to have demonstrated the right non-recurring cost (NRC) to set up and industrialise, and the right recurring cost (RC) to produce (staffing-hours per ship set, transport pricing and so on), as well as demonstrating fit for function at the right weight and industrial lead-time.

This series of balancing acts becomes more complex and drawn out at component level with every step towards an extended enterprise where suppliers are granted more autonomy in order to access their skills. This approach has many benefits to support it, but working with a range of risk-sharing partners (RSPs) also leads to the possibility of late intervention in the key design integration steps, as others in the aerospace industry have found.

As a major development traces its route through the various stages, encompassing non-specific design, structures, airframe, systems and equipment design, there are overlapping strands of activity taking place at the same time. There are components (such as wing skins) and major sections (such as the fuselage), and finally the design begins to converge on final assembly along with final electrical routings, cabin furnishings, avionics, engines and test programmes. A certain amount of this can be simulated in digital mock-up (DMU) environments, or in part- or full-scale test specimens, but the development risks remain and are a hazard to schedule adherence.

Picking a route through this is a delicate task, from a project management and planning point of view. Plans are constructed at Level 0 (very top level) through to Level 4 or 5 (in detail) at a component or sub-system level. The baseline planning will usually be according to the WBS and will highlight key deliverables at a recognisable part of the aeroplane level (such as release loads Loop 1 for wing on a particular date) The early planning also outlines the resources required and gives a first estimate of the financing framework, along with the headline assumptions used.

Project control can then start, with evolutions of the planning managed back to the original baseline, and controlled via a version release process, managed through formal program review meetings. In time, as layers of complexity build up, team sizes grow and the process draws in hundreds, then thousands of people. The project management process throws off masses of information reviewed at a large and growing number of component reviews, phased gate reviews, change management meetings, risk and opportunity reviews, and big catch-all project overview meetings. This is the background to **Public Works, section 4.4,** a presentation to an MSc module on major programme management (University of Oxford, Saïd Business School) five years ago.

I developed a fresh network of people to help me seek approval to deliver this lecture. While before this public work my thoughts on the accretive effect of complexity ran to a pattern but without significant order, I found that to discuss it publicly I needed to build up the process complexity in a way that helped me better understand it myself. In this manner, the process of preparing for this presentation became for me an enforced reflection-on-action piece of work drawing on the auto-ethnographic response of an insider–researcher. This, in a way, helped me to set the mental frame to approach this wider doctoral submission five years later.

Basic approaches to summarising and making sense of the complex information generated during a launch cycle include producing simplified outlook charts, standard S-curves showing data release achievement against the expected baseline, and gap management based on earned value management techniques.

Smith and Reinertsen (1998: 46) recognise that there comes a point in a development cycle where it would be good to '**avoid complex models**: most people do not understand them. Simple models can be understood by 100 percent of the project team'.

3.4 Programme launches

My experience here represents a continuous timeline, from the 1980s to the present day, of practice in leading involvement at a senior level in the planning of major product launches and derivatives. In Figure 1, for simplicity I have excluded periodic involvement in the planning of the Nimrod aircraft refurbishment, Type 45 frigates, HS146 cockpit completions, ATP pylon volume and workload oversight, and similar other excursions.

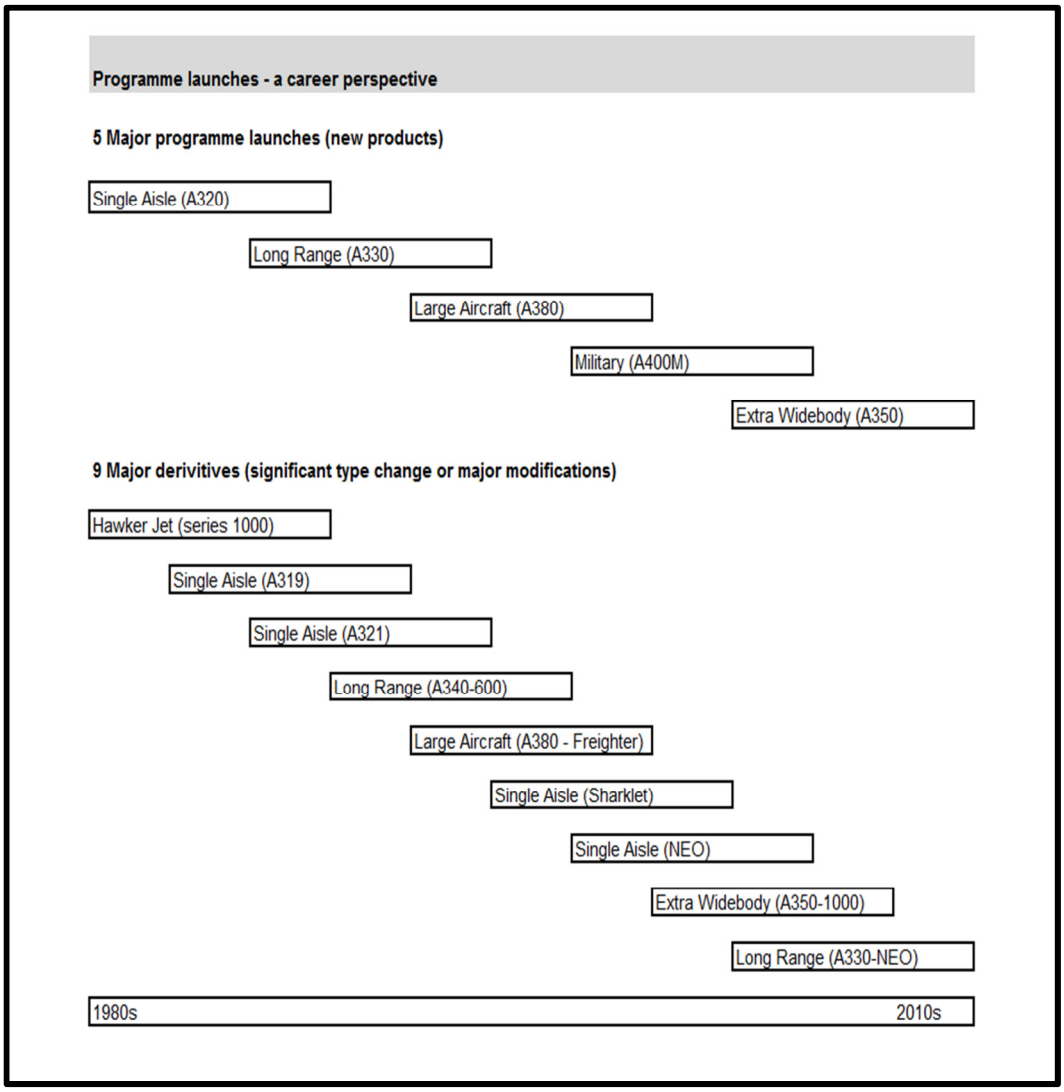


Figure 1 Programme launches – a career perspective

This is part of my context: most other planners/project managers and programme leaders only get to experience a fraction of this variety, but it is this range and continuity that have helped frame my knowledge and experience.

3.5 Key themes placed in production cycles

The next part of this context statement is a more detailed look at the development phases, allowing me to expand upon the dominant themes from this piece of work and where they fit in. To avoid focusing on any particular product, company or supplier more than another and to eliminate confidentiality issues, I have elected to discuss the phases from the perspective of a 'hybrid' product development cycle, an amalgam of all launches across the full range of companies to which I have had scheduling access. What follows is a career view of experience from accessing Tier 1 and Tier 2 suppliers across various programmes for Hawker Siddeley Aviation, British Aerospace, BAE Systems, Airbus and others. It is therefore a generic synthesis of multi-product/multi-company experience rather than a critique of any particular launch cycle on any particular product, company or supplier. In a way, this is the first point of reflection for me, the fact that I can merge the experience of multiple launches into one atypical one.

The ability and desire of the organisation to listen to schedule risk and uncertainty in a launch cycle varies considerably, affected by the prevailing culture (nurturing/listening or closed and assertive). Pettigrew et al. (1992: 268) refer to the 'Distinction between **receptive and non-receptive contexts** for change where we mean by the term "receptive context" that there are features of context (and also management action) that seem to be favourably associated with forward movement'. It can vary, too, with the climate that prevails at various stages in the cycle. As a product evolves from the design concept stage, through manufacture to test and verify, and finally into standard series 'run business' mode, it passes through some highly distinct phases (Figure 2 below) that act on the response required from planning. The way that this is experienced, reflected and acted upon has a profound impact on the way that the roles are experienced by the planners themselves, as much as on how the service is appreciated by its audience.

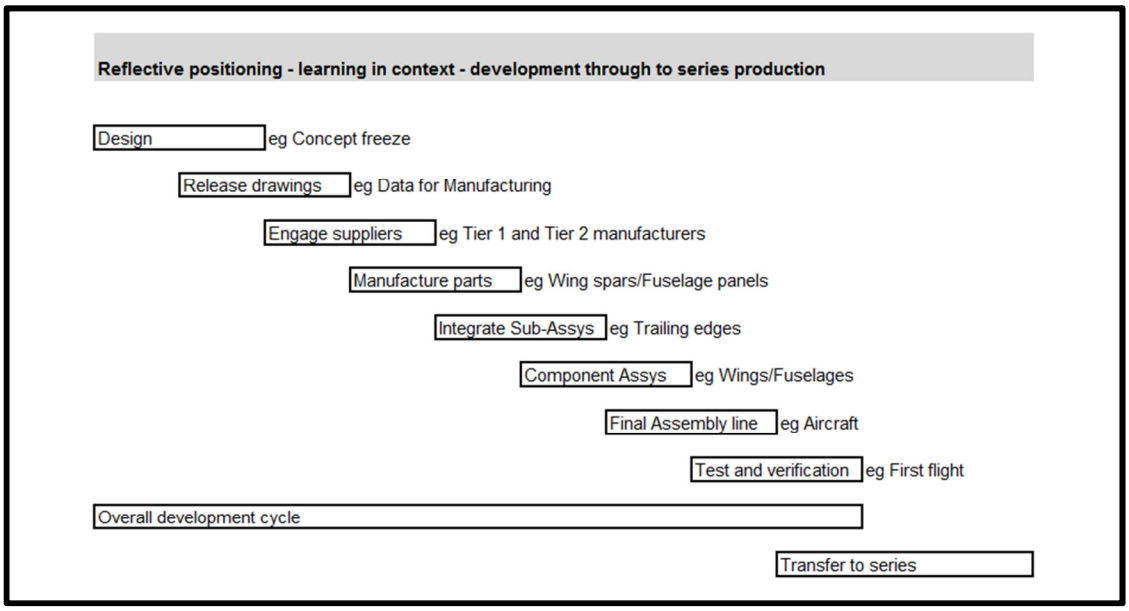


Figure 2 Learning in context – development through to series production

Figure 2 positions the phase descriptions that ensue as a framework to set the three of the four key themes against knowledge/ways of working and tools.

My own **personal learning** – about what the climate is like at various stages in the development cycle, and how that affects the deployment of planning knowledge, ways of working and tools – is summarised in the pages that follow.

3.5.1 Concept freeze

At the outset of a programme, at the front end of the design phase (Figure 3) the **climate at concept freeze** can often be:

1) Collaborative

2) Collegiate

3) Engineering-focused

4) Non-confrontational

5) Little understood by the wider business.

This is the part of a development schedule that Smith and Reinertsen (1998: 49-65) refer to as 'the fuzzy front end'.

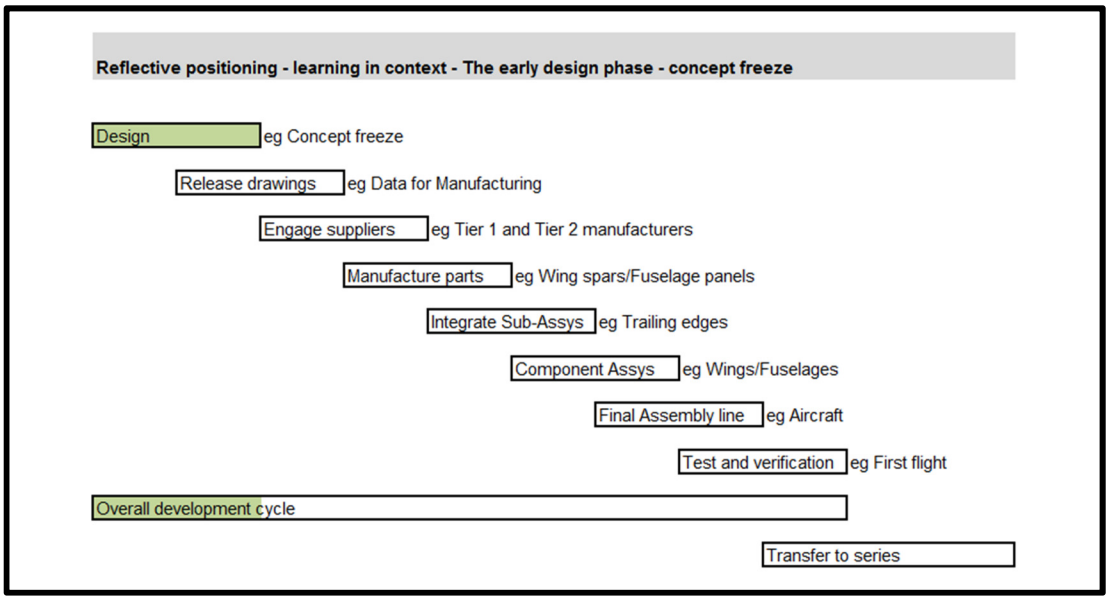


Figure 3 Learning in context - the early design phase - concept freeze

It can be seen as;

1) Shrouded in mystery

2) Focused on technical outcomes

3) Focused on quality, not time.

It tends to involve a limited number of experts rather than mass assemblers and eventual producers. As a consequence, it may lack schedule challenge, rigour, penalties and public scrutiny.

Any delay at this stage runs with the assumption that those downstream can effect time compression to recover. The measure of the schedule at this stage is in **months**.

Contribution

This is an area where I have contributed to knowledge (learning curves) on ways of working (positioning planning team members into the early/critical reviews) and on tools (through updating the learned outcomes folders ready to accept new product data). At this stage, then, I would draw attention to the impact that my work has had on knowledge (**Public Works, section 4.2**). Critically, this has focused on establishing the correct structural build cycle time **learning curve rules,** at this early stage in the product life cycle. This is a significant input to

everything from the business case to the phasing of key capital investment decisions, based upon blending previous data from prior launches with company templates and statistical analysis. Before adding a knowledgeable input to this phase, there was always the risk of the cycle planning outcome being targeted unrealistically by ignoring previous products' demonstrated performance. After control and influence is exerted on this phase, the result can be:

1) A clear appreciation of the core issues

2) A logical debate on options

3) The opportunity to shape the debate and establish relevant targets, based on a clear opinion and challenge.

The key to the approach that I adopted is to decide the key issues in the interpretation of competing data sets and to establish the impact of claims around what 'correct' actually means in this context. The central, standard definition of the appropriate learning response on which to base new product planning may be a standard 100 set/85% curve, yet the accumulated previous product-level demonstrated performance may differ. The impact of where it differs (if it does), why and by how much, and the significance of this delta in practice, means that careful thought and consideration is needed before drawing conclusions sound enough to plan on, yet simple enough to explain and deploy.

My answer is to be open to the best of all views and to reach a compound solution that allows for tactical 'bridging' to protect the most vulnerable aspects of the resultant planning. An overview of structural cycle time and learning outlooks is expanded upon in more detail in **Public Works, section 4.2.1**.

Later on in the overall process (Figure 4), as it becomes clear that the raw data needed to start the supplier and manufacture activity may be beginning to run late on baseline schedules, the **climate at the data release (DFM) stage** shifts towards being in the full glare of programme management scrutiny.

3.5.2 Data release

Many company programme managers would really like to be able to show a compliant plan at such an early stage, thus the prevailing group-think tends towards 'yellow hat' thinking – positive, benefit-focused, optimistic (de Bono, 1985: 91-114) and making sure that any risk is balanced by an opportunity. In practice, this means that any slip to plan already evident must be recovered before the product leaves its 'perimeter'. There can be a real appetite at this stage for to embed opportunities in the planning, but little to quantify schedule risks.

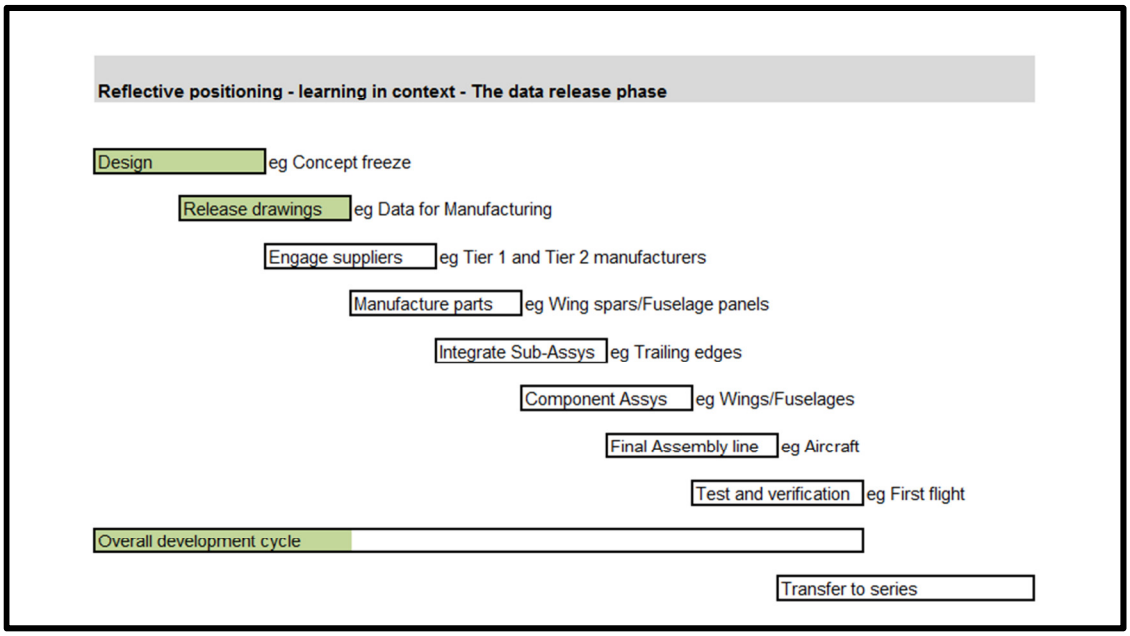


Figure 4 Learning in context – the data release phase

This tendency towards what many writers – Smith and Rheinertson, de Bono, and Paul et al. – refer to as 'optimism bias' or 'sunny day' planning demanded an effective planning response. This came in the shape of what I called the **cardinal rules** planning process expanded upon in the **public works, included in section 4.3.1.**

Contribution

The approach that I initiated here (and still use) was to drive the decision making up several levels in an organisational sense and, in doing so, to reach out for a simplified summary of what 'any reasonable person' would expect 'good' planning to be built upon. These simplified rules (such as planning for the

engineered work content to be met in full, planning to observe bank holidays as rest days, and so on) are then cast as cardinal rules and deviations logged as a move from green (good!) to amber or red (more risky).

Despite some resistance, particularly regarding personal responsibility and boundaries to ensure holidays, this approach has been widely accepted as 'best practice'. It has been a great satisfaction to me to see this approach added to company-level transnational governance. It also has the intended impact of acting as an effective 'brake' on over-enthusiastic opportunity-cashing early on in development programmes, providing a calm background against which to conduct reasoned debate and analysis by means of appealing to what Dickinson (1906: 24) referred to as 'the general good'.

As this development phase progresses, the tendency is towards planning to recover any aircraft major component assembly (MCA) development slippage before the section is shipped out to the FAL. It tends to be the case that any forecasts from engineering are treated as 'best endeavours', and it may be considered poor form to challenge these. Consequently, all development schedule risks are concentrated downstream on procured parts, supply chain and assembly. However, the data on all major product launches over the last twenty years indicates that these engineering data release plans are generally optimistic. Quotes during this time may include, 'We'll double the number of checkers and approvers and release the drawings in half the time', or 'it will be different from last time because...' Thus a component level plan may be prepared using optimistic assumptions in such a way that it theoretically closes off the schedule risk yet may not deliver. Pressure then shifts once again to downstream activities to mitigate the delays. Ironically, the very planning assumptions that were signed up to as a protection from inappropriate assumptions groupings are now seen as an invitation to cash in and take on more risk, rather than a warning not to!

It can be difficult to make a common-sense approach heard in the trade-off process at this point. All the focus is on theoretical solutions that lead to a plan with no reported overlaps. Suppliers that have not yet signed full terms will often comply with any degree of compression rather than risk pushing back and being de-selected at a later stage. Manufacturing Engineering (ME) teams can see

their role as helping by compromising and giving ground, instead of being clear on some 'lines in the sand' about what is needed and sticking to this. As a consequence, there can be real doubt about the quality of the S-curves (tracking data used to plot progress) on data release at this stage. Do they reflect real and achievable outputs, and do they meet basic right to left scheduling requirements, honestly expressed?

This phase unfolds with ME behaving as a compliant last stage of a 'we can' integrated plateau, rather than the first stage of a demanding customer 'I want this then'. As a result, the S-curves can be either missing, incomplete, wrong, moving or not to standard rules. As a direct consequence they may become widely distrusted, and schedule overlaps can be either not mapped/wrong (understated) or not clear enough to draw any conclusion from.

A valid option for a planning way of working here was exercised during the last couple of product launches. It consists of writing the S-curves jointly with the ME and Design Engineering and Programme teams to ensure balance and validity bearing in mind past event experience. At this stage new product planners take a stance of being helpful 'non-combatants' or internal consultants, because to wear any other hat means declaring sides and being badged as manufacturing- or engineering-biased in an intensely argued trade-off. If S-curves exist at this early stage, they are typically maintained by PMOs. These may exhibit an in-built bias towards showing compliance, and are often temporary agency workers (Robinson, 2014: 16) keen to follow the process but not empowered enough to challenge it, and lacking the in-company experience to recognise the repeat nature of the patterns they witness. The charts often display a left to right view of what 'may' be released by the engineering team, but it is really a design forecast rather than a business requirement. Overlap discussions and a clearer risk commentary can be quite unwelcome and viewed as 'un-teamy' input. It would be easy to view charts at this point as demonstrating compliance rather than encouraging challenge.

3.5.3 Suppliers, parts, and sub-assembly integration

These three phases, grouped together, embrace supplier component manufacture through to early sub-assemblies (Figure 5). It is a period often characterised by challenge:

1) Accompanied by some degree of confusion

2) Punctuated by poor data boundary management

3) Encouraged by project managers hungry for a compliant plan with no overlaps.

The culture is very much one of looking forward to 'can do' and does not really want to hear 'should be', or 'better if'. The schedule currency is beginning to shift towards **weeks.**

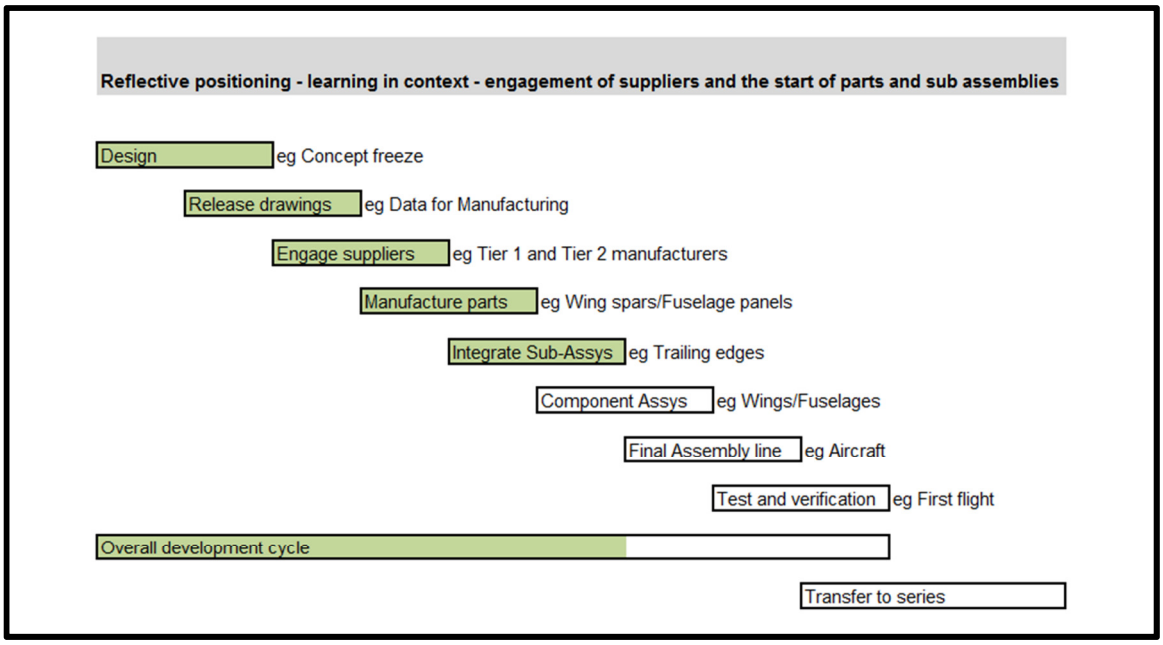


Figure 5 Learning in context – engagement of suppliers and the start of parts and sub-assemblies

Contribution
This is a point where I have contributed:

1) **Knowledge,** through supplying comparisons to prior launches, through trend analysis, and through providing risk views.

2) **Ways of working,** reinforced by encouraging the deployment of plant scheduling and planning roles embedded with the programme (project management) team. This provides a clearly positioned 'voice of the plant' in the project, and is often the nearest feedback that they have in terms of approximating an end-line customer.

3) **Tools/techniques,** with the impetus from me being to shift attention onto the clarity achieved by focusing on appropriate and simple measures as a reliable indicator of progress. I have used simplified heat-wave charts, overlap papers and plan-on-a-page to cut through complexity (**see Public Works, section 4.3**). Prior to using the simple maxim of executive level summary in this way, the tendency was to receive inch-thick project reports, reinforcing the complexity of the operating environment yet falling short of a definitive forward view of likely out-turns. In adopting simplifying steps there were issues of acceptance to be overcome, but building up a track record of reliability made them an acceptable adjunct, appreciated by many for serving to crystallise outlooks effectively.

The climate again shifts at the **start of assembly** (MCA), this time to a sense of 'We're all in this together'. This assembly integration phase (Figure 6) often starts with the minimum acceptable standard of data, and a lack of parts.

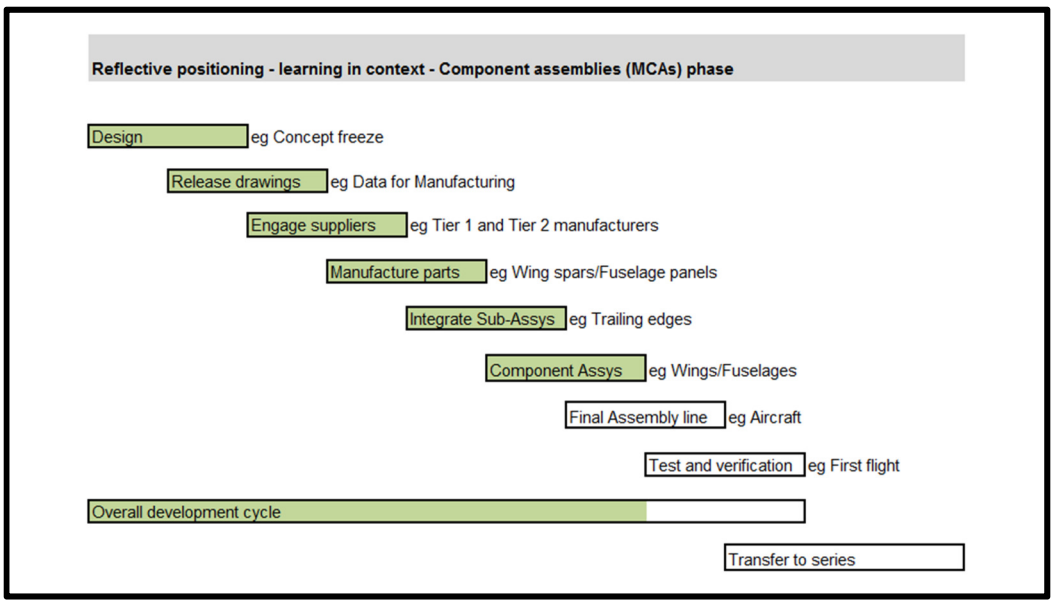


Figure 6 Learning in context – component assemblies (MCAs) phase

3.5.4 Start of assembly

The opportunity to use the early production units to conduct process confirmation, gradually proving the overall manufacturing system, now becomes secondary to the pressure to conform to plan and start on the first few build sets of components and reach the next stage in the process. Outstanding work (OSW)that in earlier phases was treated as unacceptable and not up for debate actually becomes a reporting currency during this phase, with charts of OSW outlooks prepared at inbound parts, outbound sections and all up FAL level.

System reporting 'noise' rises quickly now, delving into the root causes of delays at the same time as trying to press on and deliver. All remaining tasks to establish the MSE way of working for a new factory, all rate-of-climb work and potential improvements are, quite rightly, suspended or made to take a back seat to support a clear focus on early sets delivery. Rules may be abandoned that were specifically agreed to encourage the right climate for the learning curve to flourish, such as planning for the separation of port and starboard parts and follow-on builds to allow for crew rotation and shared learning. These may be replaced by compressed builds, leading to multiple sets in parallel and 100% jig-loading at full calendar: a red caution, in 'cardinal rule' terms.

This, in turn, may drive an unbudgeted surge in operational tooling. It may rise from core planning for a single set, shared over the smoothly scheduled early sets, to three sets, say, in compressed planning parallel working. The labour planning to support this late compression can often appear highly tactical, with major swings from three times more than planned-in work to extended periods out of work when the next supply of parts and data is not matched to the new tactical reality. At the supplier level, this can lead to machine overload and the need to sub-contract further to meet capacity needs. This focus on shifting the components out of the supply chain and into the MCAs, and from MCAs to FAL, is intensified by the scale of key-stage payments, penalty points and/or publicity gates – or all three – putting immense pressure and scrutiny on the schedule. This is true of supplier companies and RSPs, as well as major component assemblers.

Inevitably, with the centre of gravity shifting from world of theoretical data and modelling-led programmes to that of hard metal and carbon fibre in the plants,

roles and reporting voices begin to shift, too. The Programme/PMO voice can fade a little as data from the plants begin to take over. Much programme time is now taken up in 'aligning' messages and preventing twin-track reporting from emerging: conflicting status and interpretation from plants and programmes is in no one's best interest. At plant level, this stage can feel like 'a hospital pass', made worse by a clamour for more and more detailed reporting. Mass risks and opportunities trackers emerge, but are often far too granular. It can be difficult to see the wood for the trees and make sense of the probability behind the claims.

Huge personal and political pressure is brought to bear on the organisational key leaders. No one wants to be the 'longest pole in the tent' and what used to be schedule updates and revised forecasts begin to be talked of as **commitments**. There is a natural tendency to look outwards, at this point, driving schedule calls for information on how other parts of the product are performing. It is natural for the wing team to look at how the fuselage is progressing, and for it to do the same; likewise, the ribs suppliers will be keen to understand how their progress compares with that of the spar manufacturers.

In the launch plans of some companies/suppliers, this phase can spiral into unrealistic opportunity/risk bias, leading to forecasts repeatedly being wrong and missed (late). In this situation confidence quickly fades, the first independent audits start and much time and effort may be spent returning to a balanced outlook that can be relied upon. Real delivery outlooks can be distorted by weeks or months on major sections, and having the opportunity to present a balanced outlook, based on reliable data and unbiased interpretation, is as much about finding an audience as generating the outlook in the first place. At this point planning tools that have been proven to help include red reports, prerequisites packs and similar. The currency by now is down to **days.**

Contribution

From a knowledge perspective, this is a where I have contributed 'independent' checks on schedule facts plus context versus the wider airframe, and analysis on 'why are we where we are'. Comparisons to prior launches and answers to 'is this similar to last time and what can we expect next?' have proved useful and appreciated at this point.

Ways of working: Planning papers are supported now, so there is the opportunity to engage newer planners in preparing the script, learning by doing and sharing knowledge through involvement. Clearly defined planning roles are now important and a stage-by-stage/location-by-location blueprint is executed in a way that reinforces preparedness for series production (**see Public Works, section 4.1** for more detail and extracts from the public works used to position company opinion on this subject). This is also where essential organisational maintenance steps are deployed (**Public Works, sections 4.1.8 & 4.1.9**) to contribute towards setting an appreciative and stable environment from which to conduct planning.

Tools and techniques: I have introduced **red reports** and **plan-on-a-page** summaries **(Public Works, sections 4.3.2 & 4.3.3)** to align different reporting methodologies and to cut through the inherent complexity of mass data, placing a prerequisite-list approach alongside cardinal rule methodology. I eventually moved this on further and developed it into a governance step of signing off the agreed assumptions behind any significant planning changes.

Next, the focus shifts to **delivering the first of the major sections** (MCAs), where the climate now changes from what has been done to what remains to do. Here the tool set revolves around 'remain to do' charts. S-curves of achievement give way to burn-down predictions of what needs to be achieved by when, to allow on-time delivery to proceed. It is now all about gaps to plan likely levels of outstanding work, the multiplier this would attract if done 'off plant', known as the folio factor, and the days remaining until despatch.

For the first time, the view extends to the technical deadlines on FAL. This means understanding that if, for example, some electrical work is outstanding on a fuselage, how long is it in the FAL before the first electrical 'power on' milestone, thus how long is there after delivery before the shipped outstanding work needs to be closed. This change in focus, up a level, drives a planning task to understand the full integration of the product, rather than just the in-supplier or in-plant issues. Awareness of downstream and next-stage processes, necessitating a new network, needs be coached and encouraged.

This begins to expose planners to cross-cultural working, which in turn heavily impacts on **organisational thinking** and, for example, recruitment for language

skills becomes an option. Additional milestones creep into the schedule for PR points, press days, FAL openings and visits by politicians. By now, **hours** have replaced days as the primary currency, in terms of both defining an acceptable delivery ('below 200 hours outstanding work per hand') and progress versus plan ('100 hours per day required to be completed, and 150 hours completed today'). Realistic costs now emerge, such as the probable presence of an outstanding work team on location for several months in the FAL that was not budgeted for earlier on, when the climate was about 'not planning for failure'. The emphasis now is about a realistic cost update.

The prevailing mood now is extremely intense, with a push/push/push theme, and outlooks are focused on plant 'commitments'. It can be difficult to achieve a fair hearing for commitments based on a balanced assessment of real, demonstrated run rates. Each outlook needs to link to the previous, with a bridging approach to explain any deviation. It can be exceptionally difficult to perform a reset in this climate, as forecasts are seen less as the product of mathematical modelling and planning activity than as a measure of management **commitment**. This can lead to a logic trap characterised by repeated resets, missed forecasts that lead to much 'noise' and intercompany fracture points involving all major suppliers.

Planning terminology often becomes highly mixed up at this stage, with people asking for a plan, but meaning they would like a reliable forecast, and so on. However, actuals are actuals and facts are facts and, as time runs out, the truth emerges.

This is a point where I have contributed knowledge about what happened last time and with what impact to resourcing. Regarding ways of working, I recognise that plans have now shifted from engineers, project PMOs, through plant schedulers, to senior manager level and that they are no longer a 'dry planning' exercise. Plans have now become somebody's career statement. Accordingly, planning tools and techniques at this stage shift towards stakeholder management, where clear **governance and sign-off processes** are put in place on changes to outlook or underlying rule sets (**see sections 4.2.2 and 4.3.4** for examples to reinforce governance coaching and buy-off pack adherence drawn from public works).

In this way, planning maintains a clear set of bridge charts on what (and by whom) is put out a change to the core planning assumptions. These changes are closely tracked and lead the buy-off process at the level of the head of supplier or plant.

Additional tools and techniques deployed now are 'remain to do' charts, which shift the reporting emphasis away from effort, input and what has been done, to what is left to do. The closure rate is overlaid on time remaining to see whether the target closure date is secure. The overriding impact of these inputs at this time is a clear sense of planning leadership on outlooks and context, stakeholder acknowledgement, process and opinion.

3.5.5 Final assembly line (FAL), test and verification

After the sections of the aeroplane (MCAs) have been delivered by the suppliers and plants, they arrive on the **FAL**. Here, the planning and scheduling climate changes yet again (Figure 7).

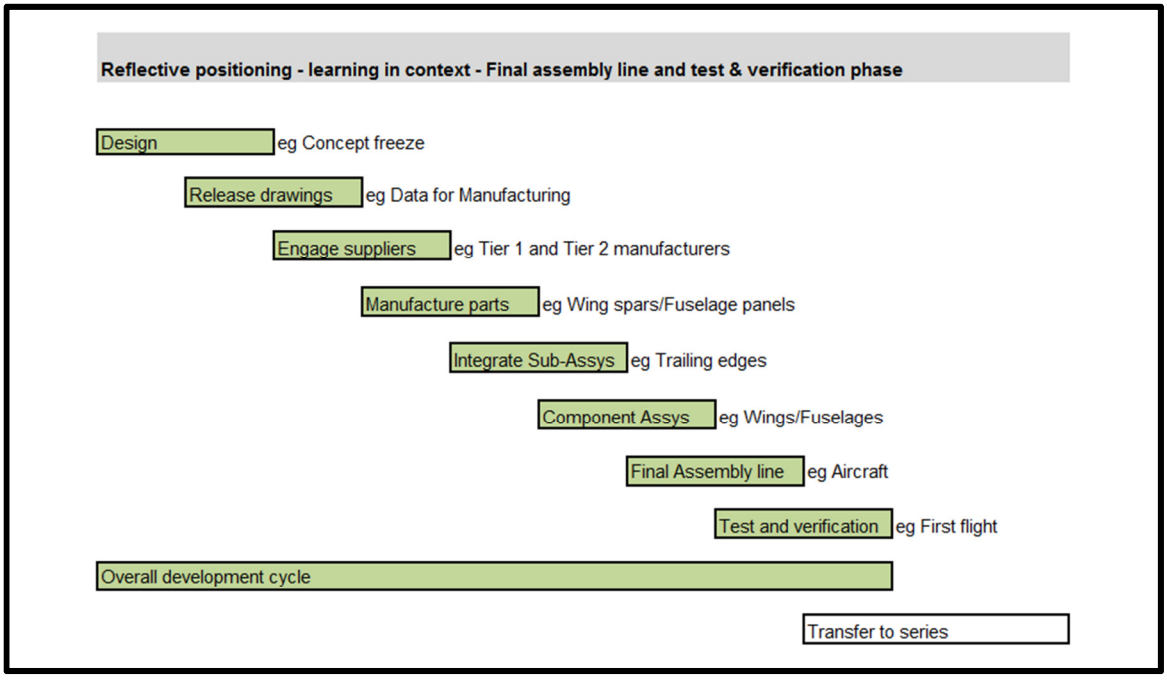


Figure 7 Learning in context – FAL and test & verification phase

Aided by being visibly one step closer to the customer, this phase is characterised by:

1) Zero tolerance

2) Instant escalation

3) High challenge.

It is very much led by technical milestones, with a strong focus on vital and easily understood project highlights such as power on and first flight. The predominant scheduling theme is to stay off the critical path, to provide good, clear signs of progress and to avoid the severe consequences of failure to supply data or progress. The **currency has now dropped a level below hours** and sub-divides these into standard time values (STVs), folio points, folio factors, open items and mods. There is concern now with understanding the inflow of new work as well as the closure rate of existing work, not just the net result.

Contribution

In these final stages I contribute folio factors to calculate outstanding work resourcing plus closure patterns, net of new work inflow, for previous products (knowledge), and templates (tools) to establish enablement patterns as a step in producing a forecast. The main impact on ways of working is to accommodate roles and support structure for outstanding work through overseas planning, effective lobbying and budget leverage. Other tool/technique adaptations in this final development push are simple, conform to FAL and programme reporting norms. This entails networking, visiting, empathising and adjusting, but the convention is clear: conform and meet agreed commitments. In this highly logical and structured application of phases and gateways, many companies, including Airbus, apply rigour and an easy-to-navigate route map to what is a vastly complex and costly development journey.

Summary

In overview, the development phase – from releasing loads data through to component development; supply chain, sub-assembly, main component assembly through to final aircraft assembly – produces a climate of its own. This, in turn, is characterised by scheduling and reporting currencies that shrink from macro/months to micro/hours, while the pressure on individuals in programme management roles increases, starting low and peaking on the FAL.

This climate influences the quality of the listening on the part of the organisation, and the type of planning data they are prepared to support and hear. It is a natural consequence, and understanding and being in tune makes a major difference to organising the planning task, and knowing what to share in what tool set and when. Lynch and Kordis (1988: 135) note that 'The right catalytic insight, placed in the right context, symbols, and perspective **at the right time**, can help people to see the light and move in its direction'.

3.5.6 Transfer to series

After the development is completed, the **transfer to series** part of the process begins (Figure 8), which can overlap with the ramp-up or the rate-of-climb stage. This is a more gradual phase. The emphasis switches to;

1) Settling things down

2) Maturing the manufacturing processes

3) Securing the supply chain before moving on to drive the learning curve and access cost improvements.

The organisation and, with it, the associated planning response, mature steadily over this part of the process. This is more about continuous improvement than step change.

Contribution
In pure series-mode, with a limited new product introduction focus, my contribution is focused on ensuring that balanced skills are available to job roles in a mutually supportive 'T' structure. This is reinforced by strong selection, development and engagement **(see Public Works, section 4.1.5)**.

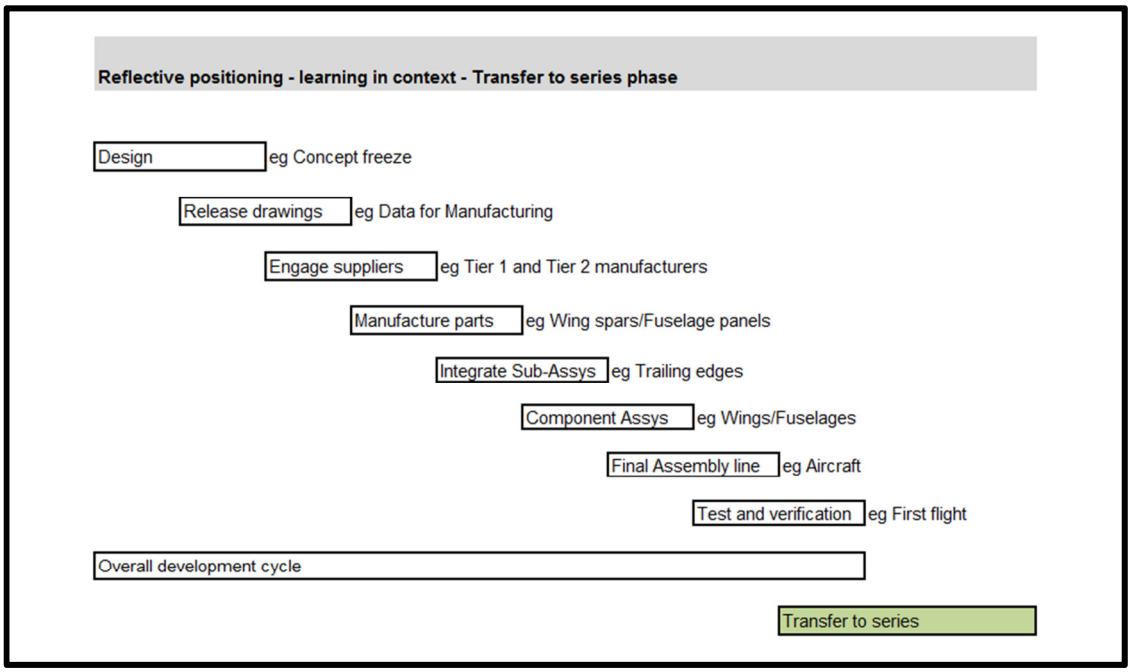


Figure 8 Learning in context – transfer to series phase

The tools/techniques that go with this phase tend towards many and varied public works on a theme of organisational papers to secure support, with continuous improvement (CI) used as a route to engagement and improvement **(see Public Works, section 4.1.8).**

3.6 Summary and link to public works themes

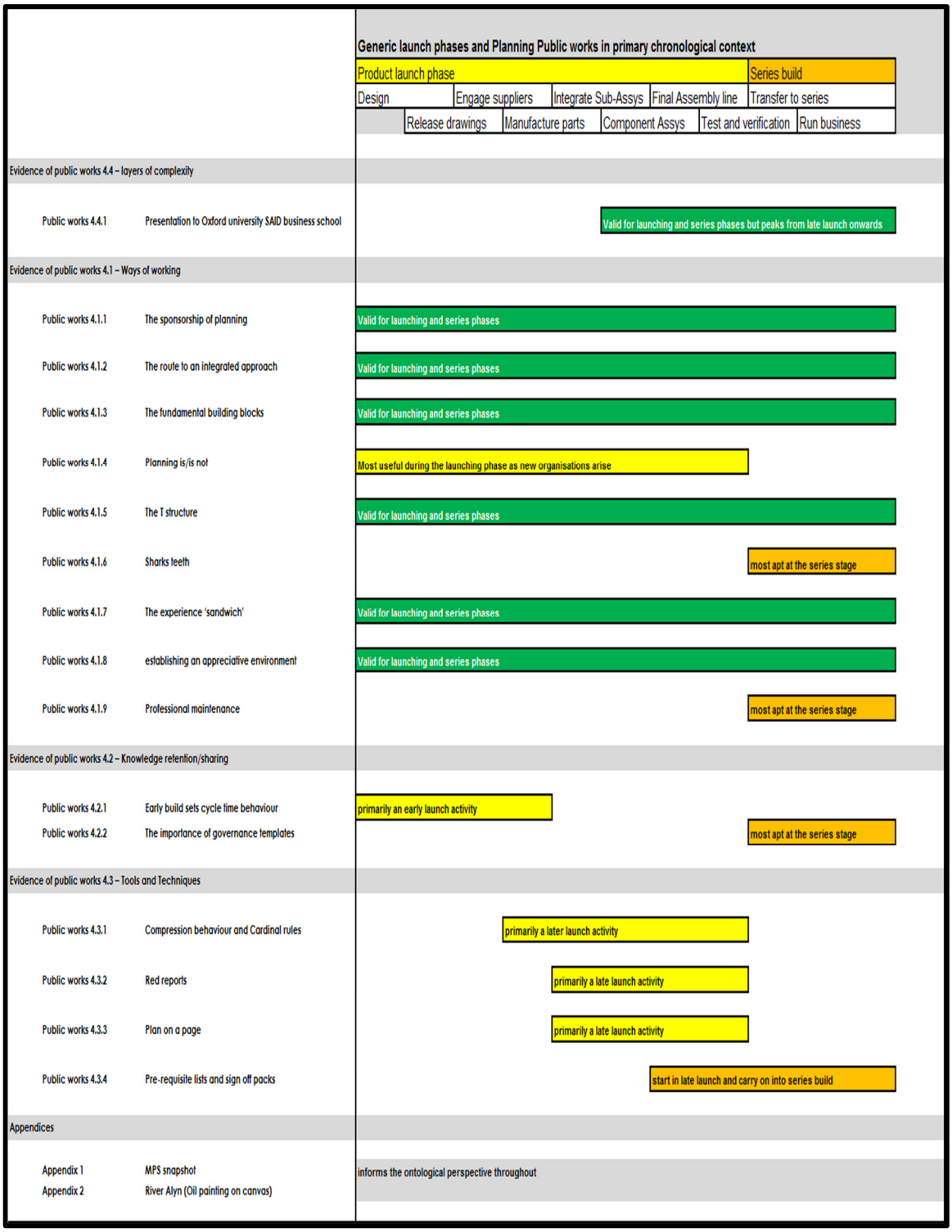


Figure 9 Generic launch phases and planning public works, in chronological order

The intent here is loosely to position the dominant public works themes of this submission in context, and to set my contributions against a generic launch cycle timeline. This will serve as a guide to where either the pull for these inputs is likely to be strongest or their impact most keenly felt.

Figure 9 shows the link between the product development cycle to my contribution to knowledge, tools and ways of working, placing them in a sequence.

3.7 Current role reach

I have summarised my personal range of knowledge-sharing using the organisation chart that captures the roles that I currently lead directly (Figure 10).

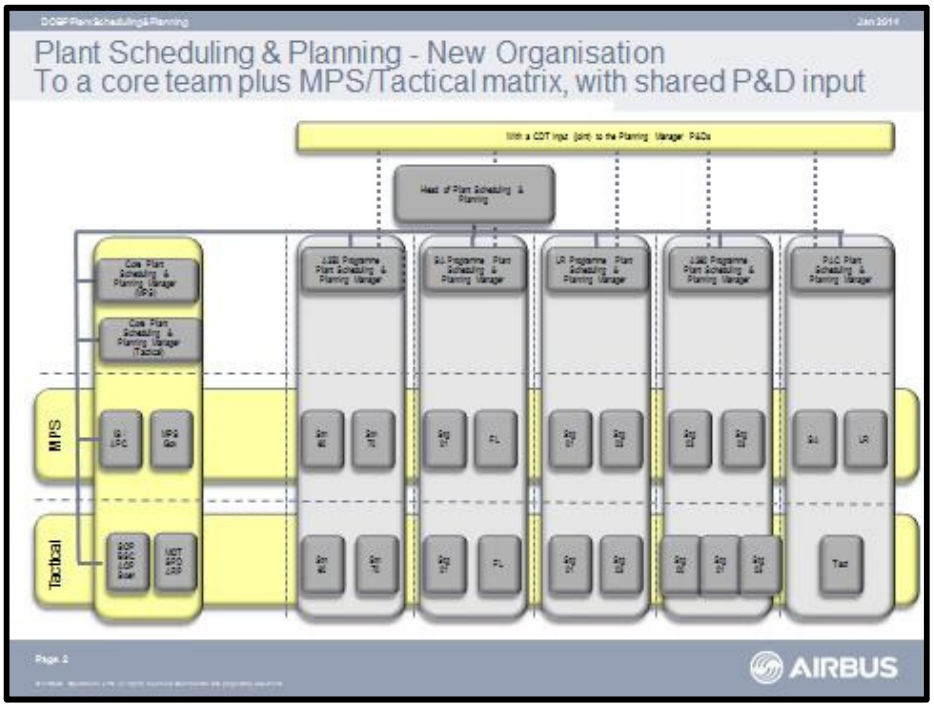


Figure 10 Organisational reach and direct impact

Source: October 2014 Plant scheduling and planning organisation

This mid-2014 matrix structure shows direct knowledge-sharing influence over a group of around forty or so planners. There is myself plus seven managers, fourteen team leaders and ten planners: supported by around five apprentices and three direct-entry graduate positions (not shown).

Knowledge sharing is through direct **day-to-day contact**, specific teach-ins that we term '**academies**' and general problem-solving **reviews.** These are as part of a wider pool where I am a senior member of the Plant Programme team of 116 people, together influencing decisions affecting several thousand people in the UK.

As part of the wider Airbus management team with roles on various councils and steering groups, I also exercise more widely the opportunity to share knowledge as a two-way exchange with process owners and leaders across the business. However, the knowledge base that underpins all these interactions is firmly rooted in the relationships shown in Figure 10.

Chapter 4 Public Works

4.1 Ways of working

The sections under this general heading of 'ways of working' draw heavily on content from around a hundred different key papers, public works and briefing packs that I have produced over the last fifteen years or so. This has been as part of the way that I discharge the task of managing stakeholders and delivering positional clarity to teams of planners. In preparation for this part of my submission, I drafted some of the key points I wanted to cover. This helped me to reflect upon the key themes emerging from a career view of leading a planning organisation through a variety of task, positioning, sponsorship and focus changes. It also helped to stimulate in me the process of identifying what might be done better in future, based on structured reflection on the process so far. The next step to this roughing out stage was to settle on a **thematic framework** beneath this social model of life in the planning workplace. Some reading on how to categorise/label and use 'bins' to sort my observations (after Miles & Huberman,1994: 18, in Costley, Elliott & Gibbs, 2010: 121) proved helpful, leading to the early steps of framing and categorising this subject area.

From this framing I have elected to separate these public works into a series of key areas. These areas cover: how I have had an impact on the evolution to an integrated task suite; the key building blocks for integrated planning in a complex environment; and essential maintenance to nurture an environment in which planning can be conducted reliably.

Before my intervention, the planning organisation had relatively low-level (sub-manager) basic planning with different pay scales and job descriptions in the various product areas. This meant there was little standardisation of roles or tasks, and the variety of approaches to common themes reflected geographical separation. Planning was performed largely 'top down', as an administrative cascade of dates to reflect changes in the order book, but not much more. Recovery plans were the task of operational support teams: a statistics group took care of reporting, while resource levels were something for HR and Finance to deal with. The **impact** I would claim is in creating and positioning **a uniquely**

integrated planning community within a major multinational company of over 100,000 employees. I achieved this by making a fragmented set of assorted tasks and people, supported initially as a pseudo-engineering activity, into a professionally managed mini-function or COC in its own right.

I needed to grow integrated planners and develop them, retaining sufficient to keep a key task running with no deterioration in quality, and in turn this drove an adaptive accretive approach to creating, developing and sustaining. I claim also that I raised planning by two operational levels and **created roles** that were interesting enough for people to stay through nominating new team leader and management grades. This helped to attract potential talent and lock vital skills in for longer, so that a graduate trainee would stay for two to three years at manager level rather than move on for promotion.

I also **raised expectations** of what a planning team could and should do: setting a new standard that lifted the individuals' professional profiles and had a profound impact through expecting planning managers to:

1. Hold transdisciplinary opinions
2. Dominate the data and the knowledge of how to use it effectively
3. Be able to translate plans from dry data (start here/finish there) into labour and skill impact, employment consequences and inventory out-turns, and know how to optimise these for a balanced outcome
4. Secure senior level stakeholder buy-in along the way.

However, accountants join an organisation as accountants, and engineers as engineers, but planners are different in major companies: they need nurturing and shaping, because no one arrives as a fully functioning 'integrated planner'. They need coaching, developing, encouraging and showing the product, process, IT, the data and so on, and an introduction to a simple to understand and shared way of working. The papers that I produced and delivered serve to help, and some are presented here to illustrate this theme. In the wider organisational context are logistics planners dealing with MRP, lean consultants doing work-package level planning, manufacturing engineers doing network

scheduling and project planners managing project plans. **I have shaped practice** by creating a type of activity that is a planning approach to fit the niche between these and more traditional functions such as Finance, HR and Operations, working across boundaries to make sense of it all from a schedule perspective. So, my generic impact on 'ways of working' is in recognising this and taking the planning activity into a **unique integration proposition** that fits between Operations, Finance, HR, PMO, MRP and the supply chain.

Functions such as those listed above come fully formed into the organisational structure, but this type of integrated planning does not. It is **'off blueprint'** and, because of this, the sponsorship needs refreshing frequently on the basis of the benefits it brings and its relevance to changing the circumstances around it.

Research is essential to enhance the role of planning: 'Action research aims at improvement in three areas: firstly, the improvement of a practice; secondly, the improvement of the understanding of the practice by its practitioners; and thirdly, the improvement of the situation in which the practice takes place' (Carr & Kemmis, 1986: 165), and that is what I am hoping this work will contribute towards.

4.1.1 Sponsorship for planning

Because the resultant organisation is 'off blueprint', it demands a constant process of re-affirmation with a changing 'sponsor pool'. This, in turn, drives a need for clarity on what is the right organisation, scoping and positioning, frequently involving securing stakeholder approval. This area is where a good proportion of my public works is engaged in keeping a constantly evolving pack of key positioning papers conveniently accessible. Some of these papers have been used to illustrate this thesis, representing just a small part of a huge support function. My first reflective observation is that the overall '**sponsorship**' of planning is a fundamental activity, and its nature has a profound impact on the type of planning performed.

'Planning' is actually a variably defined suite of tasks rather than a single function, and may be seen as a subset of several activities. For example, network planning (detailed scheduling of individual operations to put together a sub-assembly, eventually forming part of a wing set) is a form of industrial engineering planning. Similarly, planning for the impact on the headcount of projects

delivering step-downs in the staffing-hours it will take to put together a wing can be seen as performance improvement planning, or a finance one, or an HR one, or an engineering one. So, when 'planning' is grouped together in one team or function to effect a better service, **it requires defining in a way that other parts of the business may not**. By the nature of the broad-reaching terminology, it will be an aggregation of tasks that require definition, often as well defined by what is described as 'out of scope' as what is 'in'.

Programme planning for the Broughton wing factory has been sponsored as a coherent (but changing) task suite by six functions over four decades, as follows (see Figure 11):

1980s **Manufacturing Engineering**, then the local **Plant Board**

1990s **Supply Chain and Logistics**

2000s Multi-plant **Centre of Excellence,** followed by **Performance Improvement**

2010s **Programme in the Plant**

Each of these changes in support delivers a shift in the way that power is conferred within the organisation, potentially altering the task suite and focus, brings headcount and skill challenges or opportunities, and requires internal papers on positioning options and recommendations for action. These perimeter changes always provide an opportunity to renew stakeholder support and drive change/improvement. The vehicle that I have adopted to pursue this has often been through **published works,** shared transnationally to wide audiences.

As an example of the impact that sponsorship swings have, a move from supply chain sponsorship to performance improvement as a functional home within a centre of excellence approach tested the logic of how planning changed its (then) shape. One obvious shift was in expectations, from understanding the effect of demand changes at parts level in the supply base (before) to pursuing transnational communities of practice as part of a multi-plant function (after).

In practice, this meant less time evaluating part-number implications and more time at a planning practitioner level, establishing working community links with St

Eloi in France and Bremen in Germany. This type of emphasis shift is profound and needs to be led.

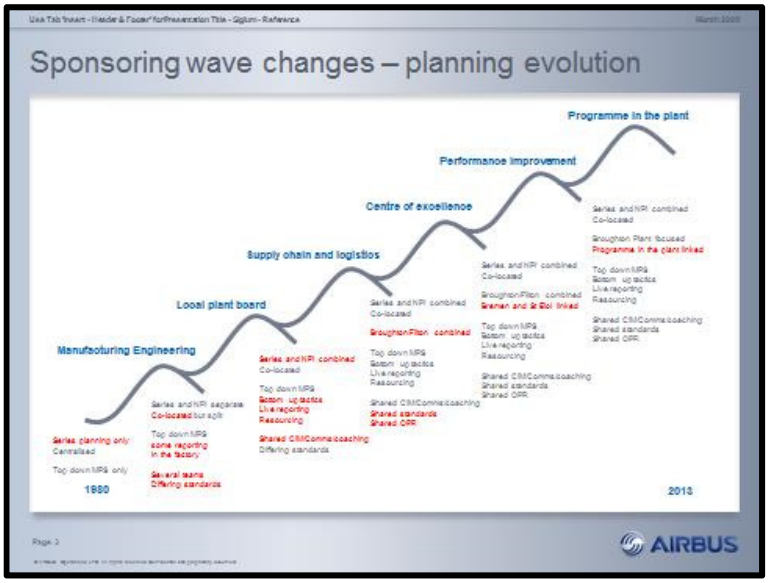


Figure 11 Wave change sponsorship – planning evolution

Source: Waves of change paper v3 – Oct 2013 – Phil Bailey

The process of capturing key themes and changes in a paper has been one of the ways in which I have adapted to and embraced the waves of change through the wider organisation. I recognised early on that one has to understand, anticipate and welcome such change. As Lynch and Kordis (1988: 71) point out in *Strategy of the Dolphin*, 'managers and leaders who don't learn to ride – and enjoy learning to ride – the wave run the risk of being marooned in an ever receding pool…'.

These changes also shift the cultural leanings of the group, as some parts of the wider organisation value development and knowledge retention more than others. Introversion is tolerated more in the quieter, less volatile environment of a centre of excellence than in the cut-and-thrust of a typical operations environment, so nurturing, coaching, developing or challenging norms are re-set with each swing in support.

After each of these steps there is also the need to explain the change in shape, form and function to the planners themselves, so a change on the perimeter drives demand upward (to sponsors), outward (to peers) and downward (to planners) communications. Given the shifting nature of sponsorship locally and

the compounding effects of changes to information technology, new products, different operations structures and so on, it will be no surprise to discover that in a company as diverse as Airbus, for each of the multiple manufacturing locations there are as many variations on what planning is and what planners perform. This re-definition and scope-check is also driven by changes in personnel within the supporting organisation. One functional sponsoring group (performance improvement) had three leaders in five years, each driving a refreshed model requirement.

Ultimately, either programmes (the products), operations (new plant leaders) or the wider company itself (different reporting regimens or information technology demands) require change and evoke a typical risk/opportunity response. That all the plants in Airbus Group differ on this 'planning' task suite makes sense when you assess the different routes that it has taken to achieve a stable and reliable platform on a fluid and varying set of sponsoring organisations. Some plants have opted to keep programme cascading (the right to left element of master scheduling) within a core programme management team. Other plants have opted for the master scheduling to be undertaken alongside more tactical-level parts of scheduling, and perform both under the support of supply chain/logistics. Any and all ways of combining planning tasks can ultimately be made to work, but all have consequences that require assessing and understanding.

Much of what follows is extracts from **published works** that I have drawn up and used across many plants and suppliers to shape opinion against this backdrop.

4.1.2 Route to an integrated approach

A simple Level 0 synopsis would be that this organisational model migrated from an early 1980s small core team located in the central office area, and that it issued right to left downwards cascading MPS plans from within a ME function. A statistics department (a quasi-branch of finance) undertook the progress reporting, and this task later migrated to cost control/estimating, then shop floor operations, which reported on its own progress. Under operations, build status reporting was frequently flavoured by the sort of 'optimism bias' discussed in the context statement, where reported progress would creep up steadily, for example at an expected 10% per week (60%, 70%, 80%, 90%), but then enter a

last-minute reality check where reporting would taper off to converge with reality at, say, 98%, 98.5%, 98.75%! So, early progress would be green, yet later progress would switch rapidly through amber to red, and if there was to be bad news about delivery risks or standards, this would often emerge late in the process.

With the right to left scheduling being increasingly supported by IT, the opportunity to automate S-curve generation and build in tracking meant that there was a chance (taken) to automate the reporting and lift it into the impartial/factual world of planners. **The task followed IT and skills enablement**, with the added benefit of simplifying and standardising the production of more reliable data. The opportunity to roll up and consolidate the related resource planning data at a plant level also led naturally to the sales and operations planning task conducted by programme planning. A **standard task suite** began to emerge, which I captured as a simple listing of the core planning tasks performed and those that might be confused with planning, but were not planning (**see section 4.1.4**).

At the outset, this 'is/is not' approach helped to shape local blueprint activity in locally different product teams that were essentially performing a similar core suite of tasks, with variable support, different IT and a mix of operating grades. Opportunities were seized as they arose, to move gradually a step at a time towards linking the activities around the common 'is/is not' theme, at the same time working more closely with geographically separate teams. The shared task set was the 'glue' in any conversations between the different groups. In this way, teams from geographically separate and various products were linked by a shared narrative of what an integrated approach to the task entailed.

This eventually settled into a joined up 'function' or **mini-COC** for the Broughton plant, first of all, then UK planning encompassing Broughton and the Filton plant in Bristol. Here, all the tasks/roles and planners came under the direct control of a single group led by me. With the appointment of a new head of the Wing COE and a new head of performance improvement, there was increased stimulus throughout 2010 to act transnationally to extend the organisational reach into Bremen (northern Germany) and St Eloi (southern France), alongside the links to Filton. This was aimed at standardising the approach to key planning subjects (including organisation, roles, tasks) across all wing plants.

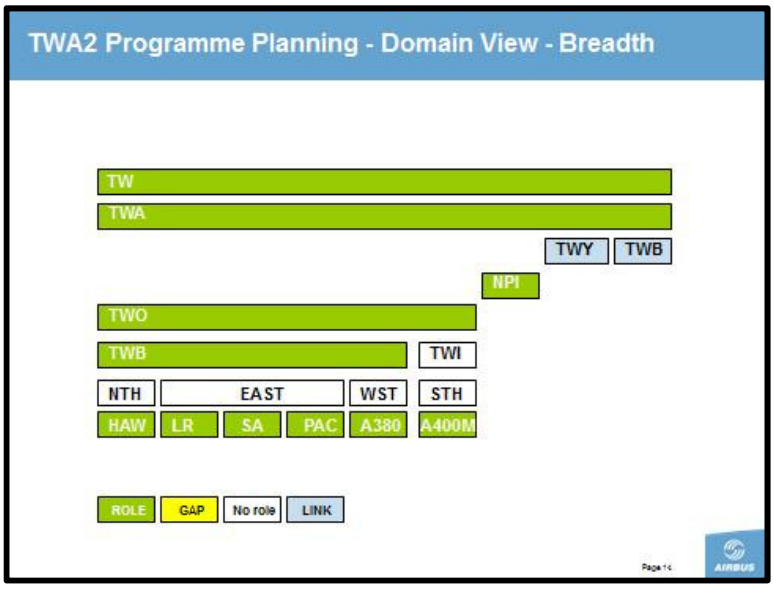


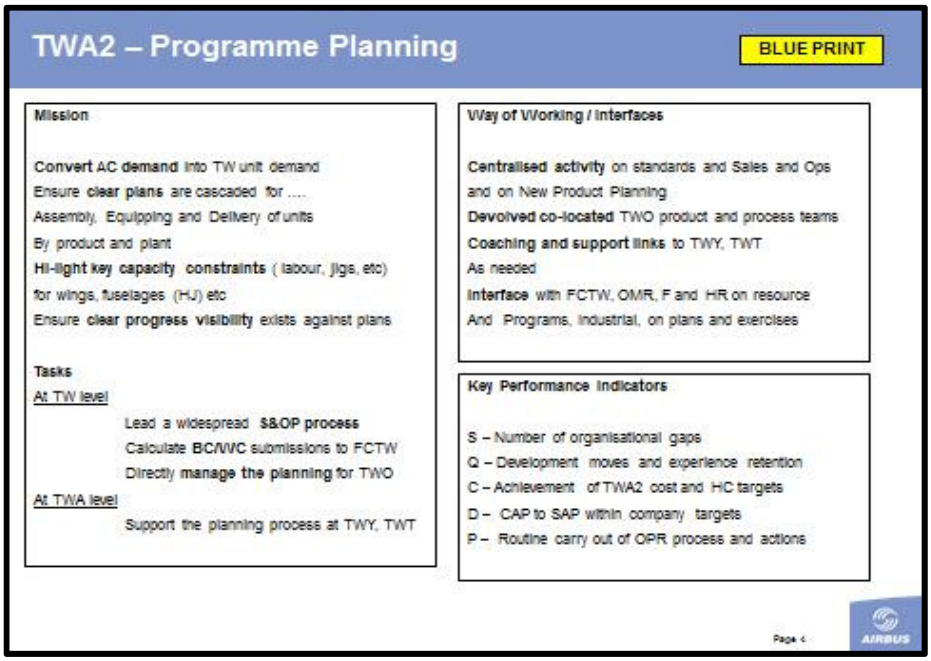
Figure 12 Domain view – breadth

Source: TWA2 organisation options; August 2010 – Phil Bailey

The chart above captures this breadth expansion well, and was used to describe how this all might link together in practice to teams in France and Germany as well, as the UK-based core teams. This change also drove a need to add tasks and organisation at a transnational level to consolidate cross-plant data and understanding. A formal transnational engagement process was launched to strengthen the approach here and, in this changed support environment, it was necessary for macro-level leadership and management to re-affirm where planning was located in the COE and that it set out to hold the rule set to which others would work.

So this integration step nudged planning further from its original 'execution only' lower-level task trans-actor role, acting out other people's rules. Now the proposition had shifted to lifting this up by an operating level to perform a management and leadership task; the implications for governance and tool sets are discussed elsewhere in this study. The progressive impact on operating levels of planners was profound, with **roles migrating upwards** from basic (P) level operating grades, which basically issued someone else's planning instructions, to AP-Level advanced team leading roles, then finally a team of seven managers to lead task deployment. I drafted a blueprint statement at about this time (Table 1) that for the first time referred to a centralised activity on standards and Sales and operations planning as well as new product introductions.

Table 1 Programme planning blueprint



Source: Handover pack – January 2011 - Phil Bailey

In the same paper I explained that **the integrated approach** to this works well because:

1) It encourages high-calibre managers into roles with real breadth and depth

2) It runs independent of the plant/function and programme, so can call late progress red and commentate impartially

3) It allows for the 'T' structure to flourish in terms of high engagement and mutual support for difficult tasks

4) It promotes a more holistic understanding and encourages a more rounded response to issues

5) It reduces attrition through providing support and stretch, rather than lower-level task execution.

This integrated organisational approach, allied with a strong sense of perimeter and task, stands in stark contrast to what I have seen externally at suppliers and in the more fragmented approach to task consolidation in other assembly factories and industries. Thus, support by performance improvement as part of a

multi-plant centre of excellence, independence, stability, knowledge retention and a strong sense of identity were all highly valued. Centralised standard setting, rolling-process confirmation and transnational working were all reflected strongly in my annual objectives and, through me, to the management team. In this gentle evolution through circumstance and sponsorship shifts, coupled with acting upon reflection, I steered planning through the use of public works papers to an **integrated solution**. I would define this condition (integrated) as characterised by the following key points:

- A common set of roles joined by a shared core task list, in one function
- In a matrix of similarly constructed roles
- With a common role content and understanding
- Supported by clear, shared, job descriptions
- Written by the planners themselves.

All aspects were supported by key aids such as the 'jigsaw' or the 'is/is not' chart to explain how the roles contribute and fitted together, built on:

- Conducting analysis before a new plan is accepted (scenarios), through to preparing the plan (MPS)
- Loading it to the information system with a shared tool (APC)
- Producing local tactical plans and tracking progress to them by means of support
- Reporting progress
- Producing recovery plans, if needed
- Calculating the resources necessary to discharge the plan
- Managing the visibility through to site- and product-level S&OP reviews.

It was conducted by being an **all-in-one professional community of practice** (planning) co-located on the shop floor with the product teams close to

production. It was knitted together by two key process streams (how to plan, and how to tactically report and adjust), led by a manager in each team area, giving weight and escalation support to difficult messages. This gives perspective to the planners, establishes great development routes for individuals and encourages a trans-product, transnational perspective. It is excellent for progression yet, conversely, a headache for retention!

The aim is simple: to provide the company with planners who understand what they are planning, can shape how that comes together, transact the plan in the relevant systems, understand progress and how the plan is doing, suggest and implement recovery or tactical plans where needed, understand the resource requirements (manning and overtime) and communicate this to the most senior and junior levels of the organisation. That is integrated programme planning.

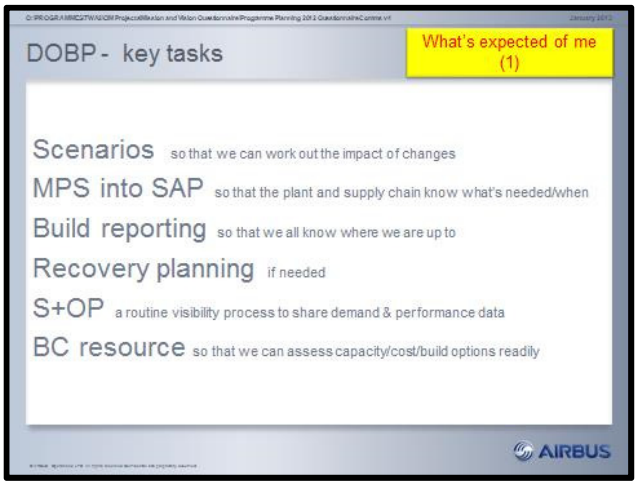
All of this is managed through a series of public works I prepared and delivered on the way to explaining how plant scheduling and planning have arrived at what consultants consistently point to as 'best in class'. I know that it works from consultant feedback and independent audits, alongside my own subjective assessment.

4.1.3 Fundamental building blocks

This section draws together the fundamental blocks of data I have relied upon to position the planning offering for new stakeholders, sponsors or planners through a series of public works and subsequent updates. Having put together an integrated planning approach, these are the elements I have found most useful when describing it to others through public works.

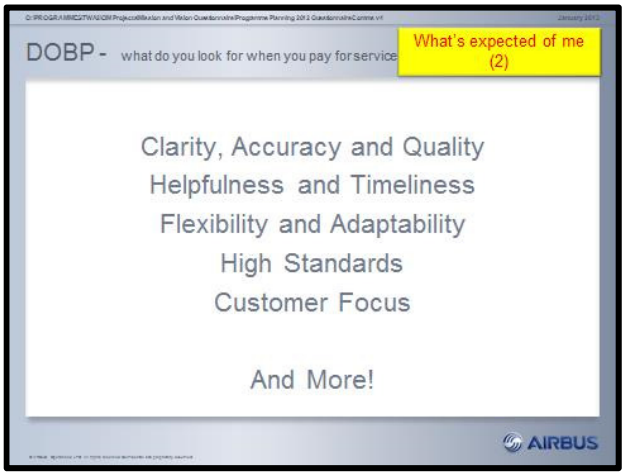
The approach starts with a clear view of the task suite, from scenarios to blue-collar resource calculations. This summary builds on the 'is/is not' approach touched on elsewhere, and it is important to keep this narrative consistent between teams. It is followed by a reminder that the professional way in which the team conducts the planning task is as important as the task suite itself.

Table 2 Key planning tasks



Source: Team communication to planners: January 2013 – Phil Bailey

Table 3 What is expected of a planner?



Source: Team communication to planners: January 2013 – Phil Bailey

Having covered the essential tasks, the context is established by showing the roles that fit it closely, and either interact strongly with planning or feed directly into or from the resultant data, such as production control or HR. The jigsaw puzzle chart (Figure 13) is an apt way of positioning integrated planning. It shows the activity in a very large organisation as fitting in the gap between other easily recognised roles, such as MRP planning or project planning. This is a unique piece of positioning that I have not seen anywhere else. Smaller companies that I have visited usually combine a number of these roles into a single, more generalist planning position, so this feels as though it is an opportunity that springs from scale.

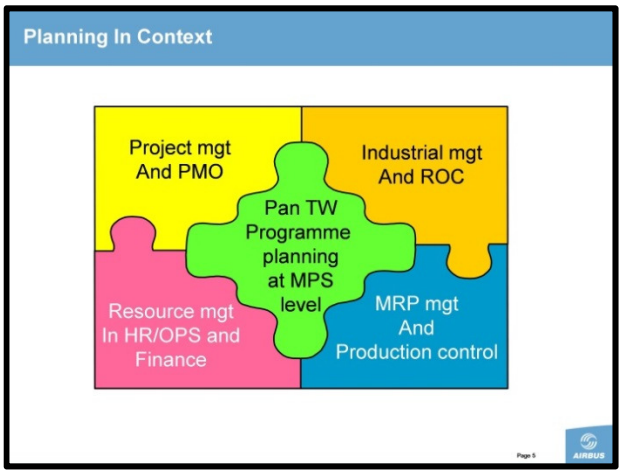


Figure 13 Jigsaw chart

Source: TWA2 – Programme planning – planning integration – a way of working paper – June 2010 – Phil Bailey

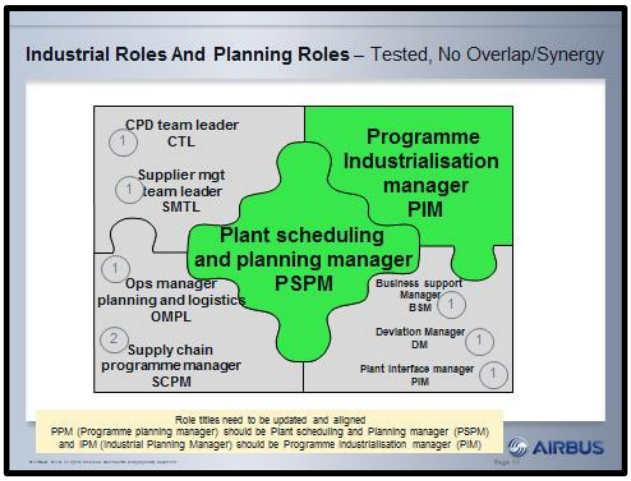


Figure 14 Adaptation of the jigsaw chart

Source: TWA2 – Programme planning – planning integration – a way of working paper – June 2010 – Phil Bailey

Adaptations to the same approach have helped a good deal in drawing out the debate around any 'grey areas' where planners will most likely be drawn into tasks not on the standard list, if a particular interface is less well understood.

The next building block is the standard team role's way of separating out the task into the three key operating levels (Figure 15), set out in accordance with the grading structure. It mirrors the increasing accountability with each rise in grade. P (professional) level planners start off tracking/reporting progress and supporting local, short-term plans. AP (advanced professional) planners generally conduct the master production scheduling, covering larger ranges of wings and multiple

stages. Band V planners (managers) tend to lead the activity for the group, establishing policy and deciding upon actions.

The diagrams are a constant reference that helps in sustaining sponsorship and understanding in the face of massive change, from plastic overhead presentations to cloud computing, and from centre of excellence sponsorship to operations, and from BAE to EADS to Airbus. They acknowledge quite simply the need to face the organisation at the right level for escalation (manager level). This is achieved in a 1x2x2 standard matrix common to all teams, while team-leading a geographical response to planning and reporting that mirrors the dominant build phases of structural assembly and equipping,

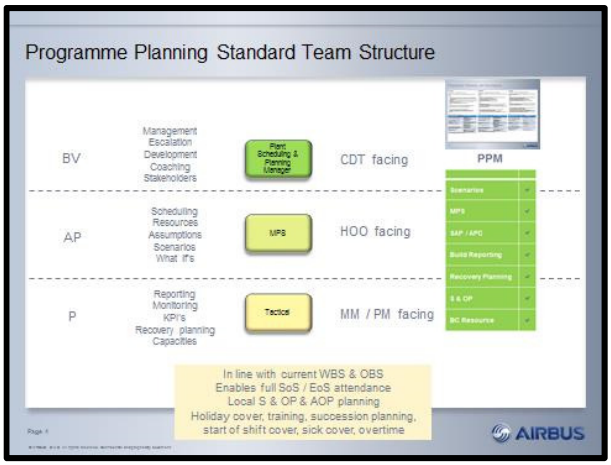


Figure 15 Planning standard team structure

Source: DOBP: Organisational challenge: October 2013 – Phil Bailey

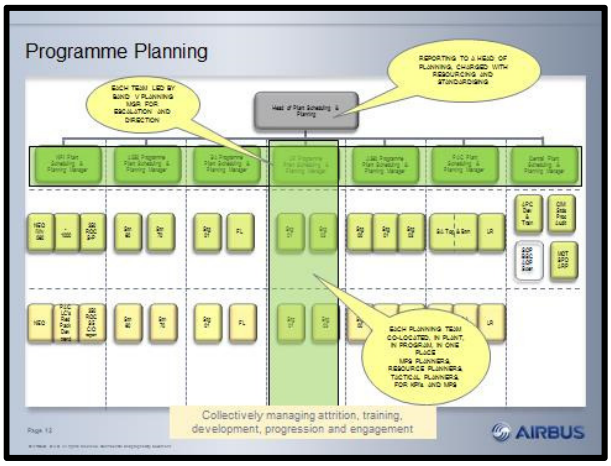


Figure 16 'T' structure

Source: TWA2 organisation options; August 2010 – Phil Bailey

These standard groupings fit a matrix organisation that operates in a mutually supportive 'T' structure (Figure 16), expanded on later. As the roles settled and knowledge grew, the chance to extend the scope (Figure 17) grew and offered an opportunity to link to other sites and plants, and to map the impact on other functions (Figure 18).

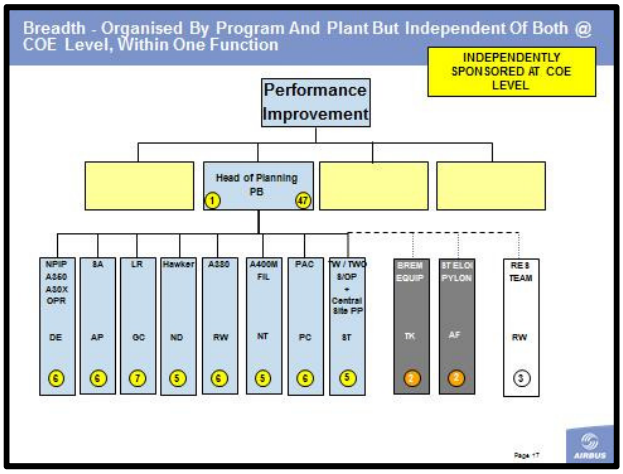


Figure 17 Position of planning within the wider team environment

Source: Handover pack – January 2011 - Phil Bailey)

A way of positioning this core team in the wider organisational context by showing links to external bodies proved useful, and in this example (Figure 17) I drew attention to the transnational process links we were working on with colleagues in France and Germany. Finally – it is useful to have a number of different ways of showing this – an adaptation of a standard responsibility and accountability chart was vital to explain how these roles/tasks/actors would be experienced by other key parts of the wider organisation. I call this the 'lightning strike' (Figure 18) because it helps show the route to 'earth' on some key planning issues, such as who decides on the plan, who is informed and so on. So for example this shows that programmes will get to share the decision to load the plan along with the production (CDT) team, but all execution remains with planning.

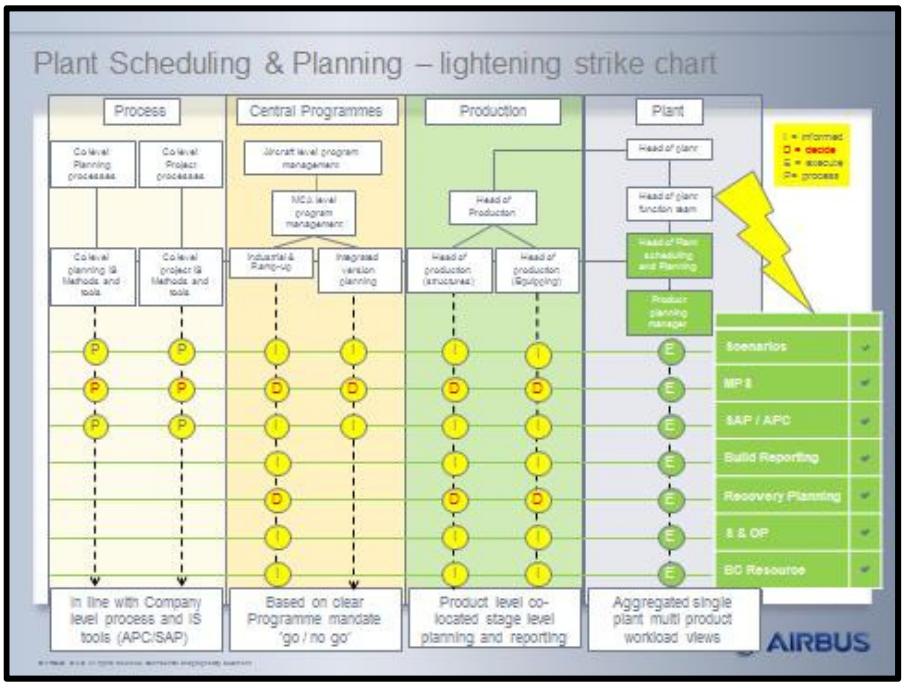


Figure 18 Lightening chart

Source: Blueprint for DOB: July 2013; Executive summary version 3.3 – Phil Bailey

4.1.4 Planning is/is not

The impact that I have had here is in isolating the power that comes from commanding data and the relationship between the plan, how actual progress is occurring, what could happen next (scenarios) and the ensuing impact on employment, hence cost. The diagrams that link this simply make the concept easy to convey, and have been shared with hundreds of planners in Broughton and openly used across many plants to help define boundaries.

Capturing the essence of what the department deals with in two simple 'is/is not' charts may seem trivial, but is not. In fact, feedback from a pan-EADS engagement session I attended in Munich in 2011 revealed quite the opposite. In this session the audience comprised two types of members from the most highly engaged teams across the whole company. The invitees were the managers of the teams and a team member who had responded as part of a highly engaged team. The session split these individuals into two rooms and asked the managers in Room 1 (the room I was in) what it was they **thought** that they were doing that contributed to high engagement within their team. At the same time, in Room 2, the team members who were part of the groups being managed

were asked what it **actually** was that their managers were doing that led to such high and consistent scores.

When they were fed back, the results were very interesting. The managers typically said that they were communicating and maintaining open access, leading by example, being honest, and so on, and that this is what they felt was valued.

What the team members said, almost uniformly, was that they were responding to a leader who had a clear view of the role of the team, understood the perimeter and protected the group from incursions by knowing when to challenge and say no. It also helped if the team was involved in defining the perimeter, establishing how to deal with ambiguities and 'grey areas' as an evolving statement.

This is at the heart of the next two extracts from public works. It helps not just the team but key customers when the team interacts to **understand what constitutes planning in the context that it operates within** and is clear on the perimeters of the task.

I captured this in the next two slides:

Figure 19 Planning 'is'

Source: TWA2 – Programme planning – planning integration – a way of working paper – June 2010 – Phil Bailey

Figure 20 Planning 'is not'

Source: TWA2 – Programme planning – planning integration – a way of working paper – June 2010 – Phil Bailey

I have used the same technique many times in working papers since putting it together, and these simple slides have been aired in Toulouse, Hamburg, Bremen, Filton and Broughton as a simple way to anchor the core offering from this group. The use of the 'is not' slide acknowledges that most leadership is not about saying 'yes', but is in knowing what to say 'no', too. A clear and often-repeated statement about the perimeter really helps by providing a black and white framework against which any debate about the greyer areas of 'task creep' can be debated. In a large organisation, success breeds more success, which in turn attracts more and more task requests that, in turn, become more and more peripheral to and distracting from the key focus. This becomes quite difficult to police without a strong sense of professional boundaries. Without them, a planner would be a little like a well-regarded GP being asked to check a pet dog for broken bones: he could do it, as his medical training has equipped him to know the signs to look for, but what the patient really needs is a vet. It is important to have a clear sense of the core tasks are for each area, and a sense of how to describe the boundary, otherwise planners may end up managing capital investment project deliverables as well as office moves and holiday arrangements. They would end up contributing to any areas where schedule has an impact, which is pretty much everywhere in a large manufacturing organisation.

So, 'what's in and what's out' is a key engagement enabler, as is involving the planners themselves in converting this into a job description. The act of translating

intent into an agreed set of words and owning the outcome has a huge impact on the sense of team and on engagement, and is not to be underestimated. I furthered **my impact here** by formalising these simple ideas into the standard three levels of job description (Table 4) by supporting a CI team activity to capture the essence of these tasks as clear roles at basic, team leader and manager levels. I went on to support and continually refresh their acceptance by the company as a **recognised role** in the company organisation hierarchy. This allowed incumbents to find their feet in the power web and move planners easily from one team to another, if needed, in the face of standard ways of working. Finally, to some extent my policing of this is elastic, entailing discretion to perform 'grey' tasks as a way of aiding the wider organisation, generating appreciation, securing goodwill and so on. Crucially, however, all parties need to be clear that this sort of scope elasticity is temporary and 'grey', and reversion to the norm will need to occur or will dilute the professional focus of the group and lead to a drop in engagement, since people will quite rightly point out that they do not know what is expected of them.

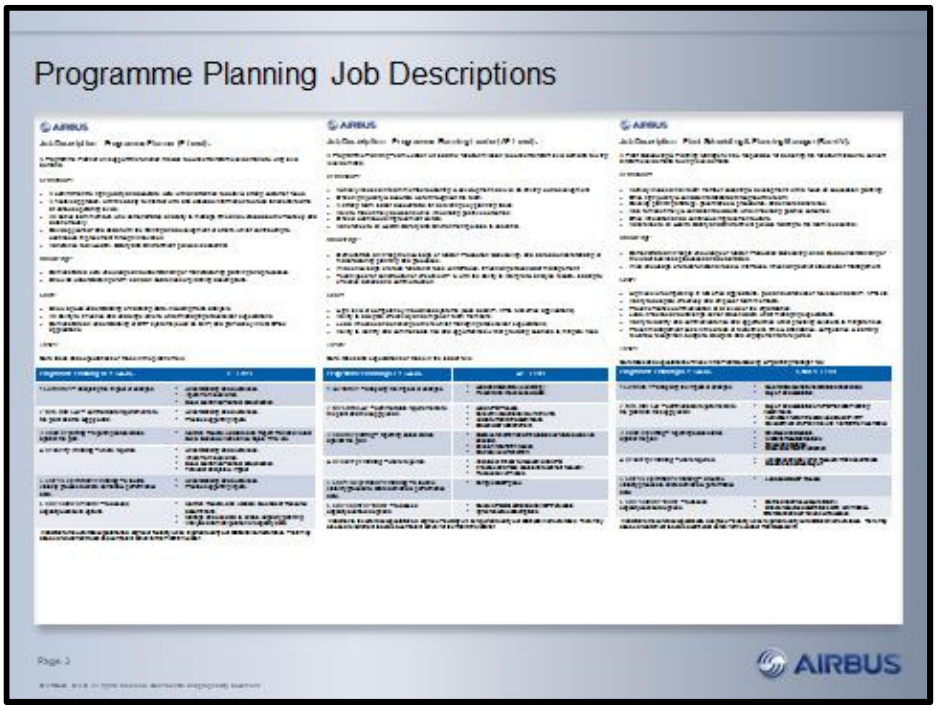


Table 4 What is expected of a planner? Programme planning job description

Source: Team communication to planners - January 2013 – Phil Bailey

4.1.5 The 'T' structure

One of the key issues that emerged from a process of building an integrated planning organisation is retention. An analysis conducted in 2009/10 illustrated the scale of the issue, with leavers/new starts during certain periods hitting a high of around 50%. While it is good to have attrition and new faces, too much movement can be hugely destabilising and prove to be a challenge in terms of retaining a core knowledge base. Initially, to buy time for other, longer-term organisational actions to take effect, I adopted a T-shaped model approach to reinforcing the team structure and positively encourage cross-team surge support and engagement.

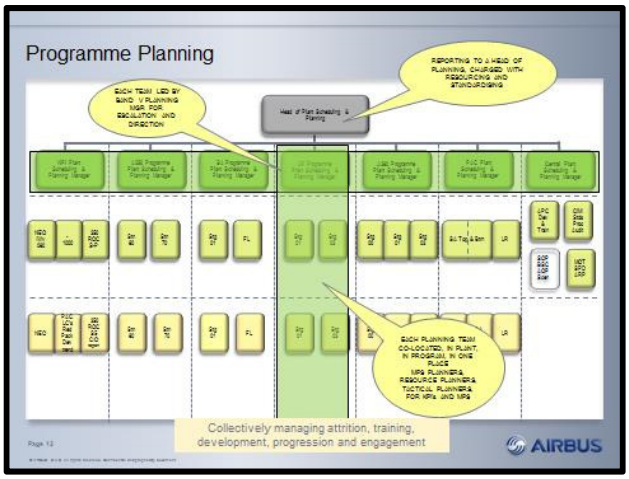


Figure 21 The 'T' structure

Source: TWA2 organisation options - August 2010 – Phil Bailey

This **'T' approach** was explained as a simple schematic. A management team in roles sufficiently senior to be heard within the organisation acted as a team and combined across products to solve issues (the horizontal part of the diagram). The vertical part illustrates the integration of a series of tasks into a common role suite anywhere in the business, such that planners perform a standard task. This meant in practice that I had to secure support for lifting seven planning leaders up one operating level to management positions, with the expectation shift that went with that, standardising the leader roles below them and the professional grade below that.

In rolling this out with stakeholders and planners from a communications point of view, it proved useful to support the diagram with some specific examples

(including names and numbers) of recent flexibility actions and surge support moves that planning had conducted. These practical instances were chosen as a way of connecting with the department's staff and customers through situations that they could relate to. The message was that operating as a pool with a variety of available and experienced staff, yet operating to standard role profiles, meant that planning could surge to support parts of the business where key issues were in danger of overwhelming the local product-facing team. No single group of planners or planning managers need tackle alone all the issues they faced. **Before** expressing it this way, there was a tendency for issues arising in one area, such as the calendar effect on finished goods stock on Product A, to be seen as needing to be resolved within that area. **Afterwards,** we saw it as a chance to buddy-up across teams to solve issues collectively. It stopped the weaker members – new starts such as graduate trainees – from being overrun and spread learning more quickly, aiding engagement by offering mutual support across teams.

There was a sense that the operating model **encouraged cross-team support**. **Reflection after the event** has led me to conclude that this was also one of the catalysts for creating the sense of acting differently that was needed as the groundwork for **establishing a critical community.** This essentially defensive step (born out of the need to offset high attrition) actually turned out to be fundamental in securing service levels and knowledge, at the same time as helping to unlock a real sense of purpose and upper-quartile engagement among the planners. In effect, the 'T' structure had begun to set a strong cultural groundwork for a robust way forward for a part of the organisation that went on to show high levels of satisfaction and enjoyment. There are parallels here to Kotter and Heskett's (1992: 16) findings on strong corporate cultures. They claim '**strong cultures** are also often said to help business performance because they create an unusual level of motivation in employees'.

So, in summary, this simple 'T' structure approach has helped me to lock learning and support in, while remaining collocated with the operations teams (rather than withdrawing to a central pool). Planning stays linked, rather than fragmented, and is encouraged to swap and surge to support others in a community of practice approach that helps in dealing with everything from

standard holiday or sickness cover to an overload of scenarios in a particular area. The 'T' structure's **impact,** then, is in the way the planning managers and their teams support each other.

4.1.6 Sharks' teeth

First of all, a definition of what I mean by 'sharks teeth' is the anticipation of gaps in the planning organisation structure in the future, and the preparation to fill them ahead of time. Planners form a group that has a good mix of high profile roles that often attracts high-potential individuals. As a consequence, promotion-led attrition can be high, and rates of up to 50% turnover per year are not unusual. This level of movement cannot be met by waiting for gaps to open up (like a shark losing its teeth), then putting in place actions to fill the gaps slowly. I cannot afford the planning group to lose 'bite' on the key programmes, so need to put in place **waves of development** that push through new planners, planning leaders and planning managers in time to meet demand. This is the recruitment/ staffing/development policy that makes the structure come alive and feeds into positive engagement scores.

The aim is to maintain the options and the strength of the team, at the same time as providing clear coaching and career paths for individuals to advance into anticipated role gaps. The message that this sends is rather powerful: that these roles are important; your job as a planner is important; and your development has an outlet at the end, as succession planning is real and important to us as a planning group.

To achieve this, I employ a series of tactics. I aim for a suite of do-able roles with interesting range, with breadth and depth. The content of the roles is policed quite strongly in a professional maintenance way reminiscent of sectors of the medical profession, as witnessed by the 'is/is not' section earlier. The next step is critical and involves selecting staff carefully for these roles. In practice, this means trying to achieve a blend of potential 'stars' alongside others who will be good planners. The two characteristics are not mutually exclusive and often overlap. We need confident and potentially extrovert leaders to whom we will listen and take direction from, but we also require thorough and possibly more introverted

analysts prepared to work the detail that forms the substance of what we do. A healthy mix is vital, and selection for both characteristics can be difficult.

Engagement is maintained by showing a career path for 'stars' and appreciation for solid performers, but, again, hitting a balance is not easy, because these almost cartoon-like characteristics are, at best, just that – characteristics –and shift with age and experience as confidence grows or wanes.

Scanning ahead for those members of the organisation we know are being interviewed for other roles, are planning to move on or looking for a change, helps us to **act ahead of gaps actually arising** and allows for advanced planning of how to drop people into these roles at professional, team leader or manager level. For the manager level roles, I anticipate gaps by mixing the attendees at our senior level reviews with aspiring managers or Aps, alongside existing managers, to accustom them to the role and allow them quietly and routinely to demonstrate their ability to act at the next level, building their own confidence in their ability to operate there.

In the monthly communications process that is undertaken to the full planning community, we share an updated organisation chart of the latest moves, new starts and promotions, so that people can see the pattern of gaps and opportunities that routinely open up and can link their own development planning to demonstrable need. This combination tends to demonstrate that **we value progression**, that it is not theoretical, that we have opportunities that they can exploit, and that we have a proven development track record that works, from higher apprentice input through to manager level. The system through planning has produced over a hundred managers for the organisation over the period for which I have kept records, and many have gone on to exert leadership influence as far afield as Hamburg, China, USA and Toulouse.

So to summarise, the 'shark's teeth' approach means reviewing the organisation for replenishment of what will be obvious future gaps, and having development waves at all levels in place to deal with this: from direct entry graduates through to tactical planners, MPS planners and managers, in various stages of development ready to slot in. This is done as a way of protecting the business by planning for service continuity in a way that links directly to engagement and

personal development. And it works. Engagement scores for this group are statistically significantly higher than the norm, and development comes in as one of the strongest scores within this.

This prevents new planners, already overloaded with learning and knowledge acquisition, from being overrun by having to manage gaps: I basically switched the focus from the normal approach of waiting for gaps to open up before starting the process of filling them, with the inevitable lag and potential service risk that this entailed, to a process of planning recruitment into anticipated gaps *ahead* of them emerging. This inadvertently had the positive consequence of marking planning as different in a professional way.

4.1.7 The experience 'sandwich'

With all of the planned movement into and out of planning referred to earlier, positive promotion-led attrition and career broadening moves, it would be easy to forget that there is a job to do, as well. This is a job that has a balance of routine and repetitive tasks (such as tracking build progress), but also complex and experience-based tasks such as planning for the disruption in a new product introduction. Both need anchoring to some stable and experienced people who can coach, offer advice, support, challenge and decide on complex issues. These highly influential planners provide the glue that holds the whole organisation together and are **vital for continuity** and improvement impetus, as well as countering group-think and driving forward challenge.

The approach that I have settled on has been to deploy a 'pincer' move on the organisation by sandwiching the newer/transitional/flexing part of the organisation that faces the product between two' bookends' that are more stable and experience led. This way, the experience is locked in by roles that stand outside the normal day-to-day tactical focus, yet remain close enough to the drumbeat of the plant to respond appropriately to the issues arising. These **cornerstone roles** can be deployed through 'bookending' product roles with NPI (new product introduction) and series (as shown in Figure 22), or by locking in the process streams shown in Figure 23 as MPS and tactical. Either approach or its variations appears to work well and, to some extent, I do not think it matters how

these roles are labelled, provided that the deployment of this 'wise old owl' input is fixed, communicated and appreciated for what it is by the wider organisation.

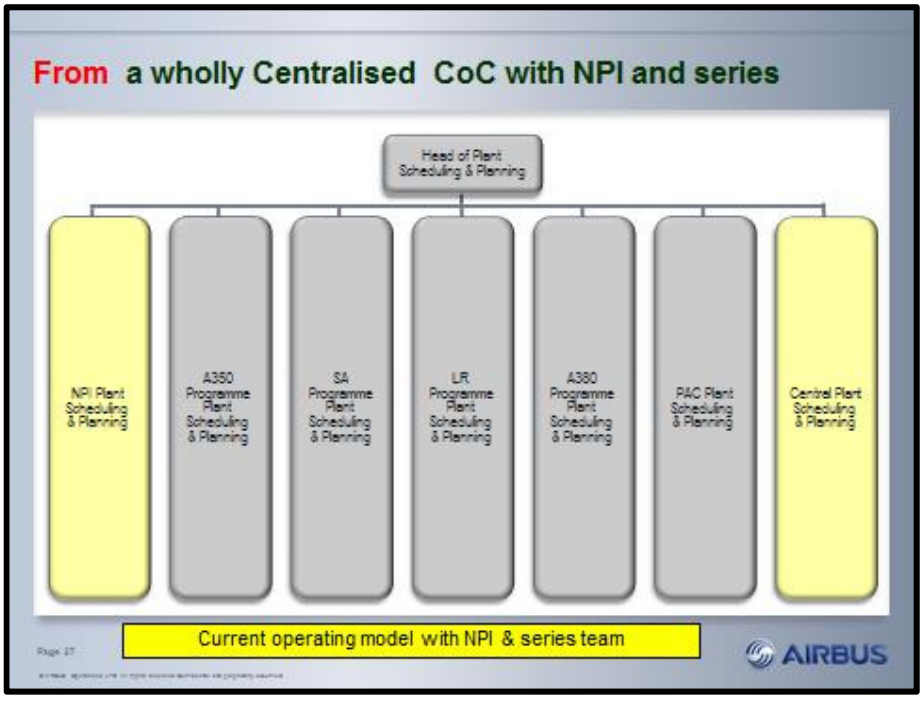


Figure 22 A new product and series way of organising experience capture

Source: DOBP communications pack to planners v4 - January 2014 - Phil Bailey

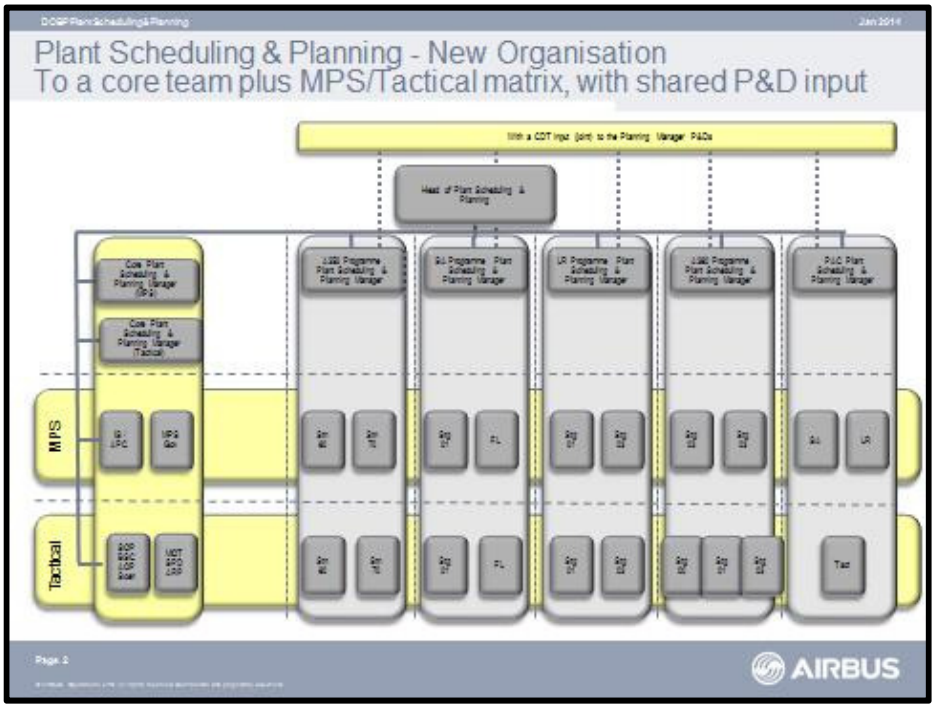


Figure 23 MPS/tactical process stream way of organising experience

Source: Organisational options paper – December 2013 – Phil Bailey

What matters most is using this experience sandwich to provide:

1) Key process knowledge to the team on **how to plan** and how to think about planning

2) **Support to new planners** and managers in a way that helps but doesn't conflict with local product perspectives

3) A reference for **what has worked in similar circumstances** before or what other teams are doing to deal with similar issues

4) An **independent** dip-check on likely outcomes on a particular plan

5) A challenging, robust input on **key schedule issues.**

Accessing this approach is easy from a planning point of view, as the management team meets weekly and has lunch together, so issues requiring shared support or an experienced input can be aired and shared. More difficult is selling this requirement in a budget-conscious operating environment where central roles may appear less 'value adding' than product-facing roles.

In the centre of excellence (COE) approach, **independence** is valued highly and figured prominently in the papers at the time, and with this came an appreciation of judgement and the 'wise old owls' approach that depends upon experience. This is a little harder to explain in a more operational environment, and requires more than just the roles themselves. Obviously, it needs strong sponsorship and experienced planners acting in concert. Sponsorship, and with it the source of power, is variable, and this impacts how we listen to this independent voice from planning. At the peak of COE sponsorship it was clear that the organisation appreciated this aspect and was a strong supporter of clear factual analysis, without pressure to conform to undertake 'group think' with its associated drawbacks. One of these disadvantages Wilson (1992: 97) defines as '**whitewashing activities**' where, 'because of a lack of security in the job, individuals cover their tracks or engage in intense and visible activity in an attempt to satisfy the demands of more senior management'.

Experienced 'wise old owl' planners with presence and impact are well placed to counter 'group think' other symptoms of which as quoted by Wilson are

equally relevant to planners reaching for realistic plans, with reliable out-turns. These include the risk of excessive optimism and risk-taking, discounting warnings that things might be going wrong. A learning point for me has been that it is very important for sponsors to recognise the risk that direct pressure can be brought to bear on anyone who holds a view at odds with the group, so planners prepared to point out a programme risk that is unmatched by a balancing opportunity will be under significant pressure to alter the reporting. The strongest sources of group think that planners tend to encounter are operations teams that do not want to be confronted with performance-related risks in assembly, and programme managers who wish to see a balanced project plan on track at all times. Under these circumstances a strong planning input is essential, or else the facts will most likely wilt in the face of challenge. This is where the value of experienced hands is felt most strongly.

My impact on practice here is in recognising and supporting wider acceptance of the 'wise old owls' nature of key experience holders and celebrating it by signalling that length of experience and depth of knowledge are valued in planning. My impact extends to the nurturing of a core that buffers the company from single points of failure and helps new starters learn quickly and cope with challenges by drawing on available experience, signalling that it is all right to do so. This is essential to **'maintain the enthusiasm of the organisation to keep focus on an unchanging mission for a prolonged period of time'**. Ward (2003: 10).

4.1.8 Establishing an appreciative environment

The need for an appreciative environment is an area where I believe I can demonstrate significant personal impact and reach, and is a whole subject area in its own right. To do it justice would merit an entire doctoral submission in this area alone, but I will focus on some headings and on what it means to me. **Before my intervention** in this area, issues would often come into the planning group and be perceived by them as negatives, criticisms or challenges. They would arise locally, randomly and might be phrased critically, so the group, for example, could be challenged on:

'Why isn't the build as smooth as we'd like to see?'

'Why can't the plans anticipate the year-end holidays more accurately?'

'Why was the cost of stock overlooked in the latest replan?'

and so on.

These are entirely natural challenges in the pressurised environment of a manufacturing facility, producing complex products to demanding schedules, but they need dealing with in a more systematic way than just leaving the planner to 'fix' the issue in the area in which it arose. So, instead of letting the fixer be whoever's lap into which the issue has dropped (a sort of 'everyone for themselves' approach), I encourage members of the group to **act collectively** on these inputs and deal with them as a team by acting in different ways appropriate to the issues arising, and then by **assessing the patterns** inherent in the issues to anticipate and head off future concerns before they have a chance to arise.

In the first instance the fix relies heavily upon the same old faces stepping in from the 'bookend' roles described in previous sections to help resolve the issues as a rapid customer protection response. While that was fine and resolved the issues, it tended to make the wise old owls wiser without necessarily sharing the knowledge around. Therefore I encouraged a more multi-planner approach to resolve issues to push forward a mix of those that would know how to resolve an issue quickly, with those for whom the experience of learning how to do it would be good for their development. Eventually, this was refined further into an approach that more positively logged and **anticipated improvement opportunities** into a forward-looking CI list of areas where we could collectively improve before issues arose, and mix the team members up to share the sense of achievement of knocking over issues before they became a problem. This evolved finally into a full CI process that combined solving issues, sharing learning, keeping everyone involved and collecting a suite of improvements before critical issues had the chance to drop in. The aim was to recast critically phrased events that did arise as urgent CI steps, **change the language**, and support a positive collective approach to improvement (appreciative), rather than adopting a negative, individual approach to dealing with criticism. The approach has many spin-off benefits, and other parts of the company were keen

to understand how this worked and how CI appreciatively conducted, linked well with engagement and people development.

In reflecting upon action here, I drew on a short paper on this subject that I presented to colleagues in Germany in 2011. In it I explained how this approach allowed us to benefit from the following:

> It helps us to mix.
>
> So if we have 7 teams located up to 2km apart focused on planning different products, normally they would never meet each other.
>
> They would be like strangers who just happen to be in the same siglum.
>
> But we look to pick CIM members from across the teams to collaborate on an improvement.
>
> It helps planners to widen their view and develop.
>
> It provides a chance to step outside the day job and work on the process.
>
> It is a chance for West Factory planners to go to meetings on process in the East factory.
>
> And understand a different viewpoint.
>
> It breaks down barriers to movement between teams.
>
> So before we did this we'd be debating moving Joe to long range and swapping roles with Peter (for example).
>
> But no one in long range would know who Joe was or how capable they were.
>
> Now the teams mix more and do have an opinion on who can move where to help.
>
> It breaks down barriers to progression between grades and helps people to be promoted.
>
> We let people practice LBIP/PPM techniques ('I ran an improvement project') that is good for the CV.
>
> It's a safe environment to learn to lead groups of people and practice project management.
>
> They get the chance to run 4 box reports and practice influencing people.
>
> It helps the management team and the planners to mix
>
> When we do a change/improvement we can have a management sponsor (one of the planning managers) and a team leader (one of the planners).

But other members of the team (including me) can be just team members.

So the planners get to see the Human side of management (were are just the same!!)

And they get to be more confident pushing their point of view.

It also helps us all to recognise potential and help that to develop.

And it gives the up and coming planner the chance to see that we want them to grow.

It encourages engagement.

Because it shows really clearly that…

Your opinion counts.

Someone has thanked me in the last 7 days.

Development opportunities, etc.

and finally…

It helps us systematically improve on the subjects that are bothering us or our CDT customers.

It sends out the clear message that it is our job to improve continuously.

It reinforces standards (with the engagement of the team).

It generates a network of experts.

This has now become one of our professional rituals that we use to create a sense of difference, reinforced by a communications update (see Figure 24), newsletter inputs and an input to our development conference planning.

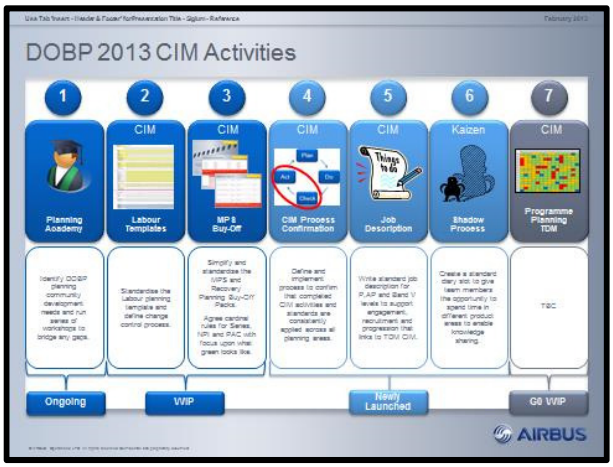


Figure 24 Rolling update on CI progress

Source: team communication to planners - January 2013 – Phil Bailey

For me, setting an appreciative environment means combining several strands and ways of working around a core theme of settling issues collaboratively, collectively in a framework supported by positive language. It means using CI as a way to solve the issues arising in a way that helps people to expand their CV and add variety to their role. It works well as a core piece of professional maintenance (Costley, Elliott & Gibbs, 2010), and part of this relies on collectively agreeing the '**common most unfavourable factors**' (Ransome, 1980: 181-184) and setting about resolving them as a team.

CI links all this up, allows the teams to mix, fixes the issues, introduces team members to managers and vice versa, shows that grade does not matter, unlocks progression and stops us relying only on the 'wise old owls'. It also allows planners at all levels to be heard, to 'hold the pen' and to claim that their opinions count, because they do.

This approach has been shared with other teams within Airbus and **is being adopted transnationally** as a logical, social and responsible approach to engaging planners at a community level. In addition, I set a shadow of the leader approach to using 'good' language that excludes no one (such as at the football stadium). I do not switch that on and off: it is me. Where I set my own world of appreciative inquiry, I also aim for planners to set a culture for ourselves that acts as an antidote to the cut and thrust of an operational environment with 'light touch' regulation and supportive governance focused on help rather than measurement. We then staff this structure well, selecting carefully, behaving

ethically and treating people with respect in **an oasis of calm certainty** in the middle of all the challenges that the team faces.

4.1.9 Professional maintenance

This is an area of thought that I had not explored in the literature in any systematic way before I started this doctoral submission. The professional nurturing of planning was a series of intuitive actions prompted either by myself, the team, or randomly uncovered journal articles that resonated. Reflection with a purpose, however, does reveal a pattern to this behaviour, so I offer the following overview of the dominant themes pertinent to planning. The key to my learning here is that these are not to be viewed as a stand-alone suite of options, something from which a selection can be made: rather, they should be viewed as accretive. Taken together, they have a cumulatively powerful effect in delivering high impact and influence planning in a large and complex organisation.

Being capable of and prepared to explain 'planning' in context is an ongoing requirement, as is being able to reset or refresh its continuing **sponsorship** regularly as the wider organisation shifts its shape in terms of conferring power, locally and at the corporate level. It needs supporting by holding and updating a constantly maintained and topical **'reach for'** pack of material. The focus of much of these packs is inevitably task and frequency understanding because, in the end, what drives sizing and shape is a compound of:

- The number of products (and therefore potential customers)
- The need to co-locate or the opportunity to centralise
- The number of types of tasks that need performing (such as planning only, or planning and reporting)
- The frequency of the tasks (daily or weekly)
- The detail of the planning (at stage level, sub-stage or minor operation level).

The next step is to **benchmark,** on a cost/size/transactional basis, against the most comparable plants of the company/system. This is followed by sharing with the planners themselves the context of any proposed changes and the impact on the conduct of planning. This is undertaken through regular **communications** and informal channels of discussion.

Managing the **process boundaries** between the planning team and other parts of the organisation is reinforced by concentrating on natural currency breaks (such as the difference between MRP planning for parts and MCA planning for major assemblies) or the different training and professional paths demanded by project planners or IT skills demanded by accessing fundamentally different systems.

The focus is tightly on delivering impact through getting the methods and processes right and accepted through agreeing clear ways of working, measures and support wherever gaps open up. **Shaping the processes** that deliver a planning result is conducted first within the sponsored domain (factory or group of factories) and then more widely into related factories building other parts of the product, or into other functional and central parts of the organisation at a corporate level.

Delivering views and solutions on (in my case) other parts of the aircraft and being asked to **deploy planning outside of the plant** builds professionalism and delivers influence, as does being able to access external to company references from other companies or sources (such as Vauxhall's organisation structure or de Bono's 'black hat' view without sounding academic or superior).

Similarly, guarding and **nurturing the team's results** and outputs closely to a high governance standard underpins being able to hold and espouse a strong vision together with a clear management view on direction and purpose. The 'vision' needs to be supported by a strong team track record of achievement. This would not work quite so well if the vision was strong but the track record was weak, as the two need to go hand-in-hand and be consistent.

Holding a clear static (now) and dynamic (future) view of the **organisation structure** is a guide to recruitment, divestment and training policy, shared openly with all the team, so that they can help at key stages of adjusting the shape. It is

vital to be clear on what proportion of roles will be or can be filled by graduate trainees, temporary workers, and so on, and where surge support, apprentices and others may be helpful in covering off maternity leave, holidays and the like.

It is essential to anticipate the loss of key roles in advance (the 'shark's teeth' approach discussed earlier), **guarding the entry route** carefully by recruiting to a standard to select those who will gain the most from the role profile and offering the most in terms of a planning return for the training effort required to help them conduct the task.

Managing the training plans and on-the-job coaching to a clear and transparent standard is helped by simple statements about what planning is/is not, and consistent coaching how to conduct the 'is' part of the equation:

- **Valuing experienced planners** and the strength that they add to the process, particularly in dealing with change, and locking these roles in to the structure in very visible ways
- Producing physical outputs that reinforce the professional maintenance through regular updates to **planning handbooks, newsletters**, organisational updates and similar
- Inviting **feedback** by talking to the team, engaging in workshops or CI meetings, or standard face to face communications meetings
- Testing it with the international community and comparable plants within the wider group and establishing a sense of community around shared core tasks. I liked the 'meeting to argue' phrase used by Freidson (2004: p202).

By 2010, the planning organisation that I lead had matured into **an integrated function** in its own right. It had achieved this though a series of locally relevant shaping actions, opportunities and professional maintenance steps, rather than in response to a top-down company-led blueprint approach. As a consequence, each plant has its own, different, planning template and responses to key issues varied widely across the group. This presented an opportunity to contribute transnationally on the subject and, for me, has included personal invitations to

'**wise person**' meetings in Toulouse and in Hamburg on aircraft assembly, electrical installations, recovery plans and major resourcing decisions. These invitations have acted to strengthen my own professional standing and position as leader in the field of planning, as well as adding weight and credibility to the professionalism of the Broughton team that I lead. They provided an opportunity to contribute by looking at the bigger picture, and to cut through noise and complexity to reach the underlying situation: what Rimington and Pollack (2007: 18), writing on the subject of navigating complexity, describe as:

> when you see **the right markers in a situation**, it can be relatively easy to steer through the complexity. What looked like a complex situation can then resolve into something simpler and more manageable. Your attention can then be focused on what is of significance.

4.1.10 Contribution to learning and practice

Contribution to learning	Contribution to practice
Ways of Working (4.1)	
Extended testing of an accretive process extending to a range of organisational settings in different companies, with epistemology logged and discussed against appropriate literature.	A clear, experience-based, critically reflected narrative on how to approach the sponsorship of planning in a complex setting. A detailed example of an integrated role set that has been proved to work including the building blocks for this approach, what is in or out of scope, how the team may be encouraged to support each other and how recruitment ahead of (and in anticipation of) gaps is of key importance. This includes the leadership/facilitator role that experienced practitioners can play in setting an appreciative framework to encourage team cohesion and some approaches to professional maintenance, not least focused on collaboration adhered by conditions of trust.
Consideration of what has worked in relation to existing literature, drawing conclusions on why they work.	Gaps in the literature that can be addressed by critically reflecting on what complex planners do and can do in terms of ways of working – for example, the planners themselves being the flexible but reliable adhesive that keeps teams together working positively. This requires them constantly to update their thinking and their own ways of working.
The structured and ordered recording of the reflections-on-action of	Demonstrating and recording what works in such a complex setting; sharing the results in a way that supports others to identify elements of practice transferability into

an experienced practitioner in the field of planning in a complex and large-scale industrial setting.	their own practice setting. Encouraging more networking between planners in similar roles, and sharing practices.
Contributing such reflections to academic and professional literature so that academics and other expert practitioners might be able to assess where future research could be usefully directed to expand the field of knowledge in this area further.	These shared and critiqued practices can be articulated and published, for example in joint publications, for the sector to test the applicability of practices. This helps to navigate complexity in different settings and to extract the short- and long-term planning differences and commonalties that can contribute to theorising.
A narrative that places enough context around the claims to provide an ethnographic validity for the work.	Ethnography is deep description of a particular 'culture', a form of case study. This critique is a form of ethnography. Sharing this 'case study' can encourage others, so theorists have a bank of data from which deep practice learning can be extracted, much like the ethnologist examines ethnographies to derive learning about human behaviour and activities, not just those in a particular setting or context. In this case, the context is a complex culture involving many practices and stakeholders. The descriptions are not of a limited field trial or small-scale project, but are full-scale; they are sustained industrial applications in a complex aerospace setting embracing components, wings, fuselages and FALs across a number of companies in the extended supply chain and assemblers, covering the full development cycle from launch through to series manufacture. The role of the planner needs to be recognised as one that facilitates ways of knowing across the practices and interests, combined with appropriate tools to facilitate success, and can work to prevent critical incidents in one section from causing difficulties in all, because of their interconnectedness.

4.2 Knowledge retention/sharing

As the seniority of some of some of the planning roles increased, so did the **influence and power** wielded by the planning managers, and the need to be clear on questions such as:

1) What do the planners know about demonstrated performance?

2) Are the planning rules that are applied actually correct?

3) Are the planners applying these rules blindly or interpreting them wisely?

Integrated planning allows knowledge to accumulate, and I have had to nurture its safeguarding as it builds up and guide its interpretation and re-use. In the public works, I have selected examples of the type of interpretation of knowledge required and how I have influenced this.

Accountants learn discounted cash flow; engineers learn about properties of materials; yet planning knowledge swings from Boston consulting group-derived generic knowledge on the principles behind learning curves that has been around since the 1930s, to the demonstrated performance on wing manufacture that local planners have recorded. My **impact** here is through intelligently **applying existing knowledge,** such as learning curve theory, yet interpreting it in light of the local demonstrated data, understanding the results that hang on this interpretation and **conveying meaning to others** that leads to **consensus on how to act**. This stands in contrast to the prior condition of blindly applying rules in a 'the computer says so' way.

The sections that follow under the general header of 'knowledge retention/ sharing' follow a similar pattern to those in the section on 'way of working', in that they draw heavily on the content of around twenty to thirty different key papers, public works and briefing packs that I have produced largely over the last decade as part of the way that I discharge the task of consolidating learning, capturing it for future planners and clarifying issues with many potential outcomes. For this particular section I have opted to reflect on knowledge retention, but have avoided the actual, rather dry, data and have instead

drawn on the link between well-argued data/knowledge and the clear execution of planning tasks and guidance. This has the advantage of averting the need for an NDA.

4.2.1 Early build-sets cycle time behaviour

My effect on practice in the area of early build-set and cycle time behaviour is in shaping the application of the cycle time learning curves, mindful of the impact that these will have and the options open to the planner. It is also in keeping and maintaining the topicality of the demonstrated performance data drawn upon to form the basis of action planning and it is in encouraging an understanding of what has happened before and why this should be taken into consideration when planning the future. This is referenced here as a way of demonstrating the interpretation of knowledge that can be drawn upon when the organisation retains experienced planners in well-constructed roles, populated by process actors who understand what went before.

First of all, what a planner means by cycle times is the duration in days, weeks or months of an activity to completion. This is different from staffing hours, in that these are an estimate of the effort that will have to be deployed over the cycle time to complete the task. Both cycle time and staffing-hour input are needed for planning, so they can be used together to make sense of a planning outcome. The combination may be used to show, for example, that a section of product may take 5000 hours to assemble (staffing hours) over a five-week period (cycle time), meaning that at 1000 hours per week it would require a staffing level of 28.6 people if they worked a full 35-hour week, based upon 1000 hours per week divided by 35 hours per person per week. So, continuing with some basics, a learning curve is a formula driven prediction of cycle time or staffing hours, where learning % = 2^b x100, and where b = log (1st set cycle) – log (last set cycle)/log (1st set number)-log (last set number). The learning curves derived from this bit of maths are used to connect the engineered target condition at some pre-determined point in the future (10 days' cycle time at set 100, for example) with reality in an imperfect launch window where people/the system and the parts are all new and settling over set 1 and the early builds. In addition to pure theory, I have encouraged recording cycle times in all wing products since Airbus started (and much data on other products, besides). This

means that planning can draw on several sources when establishing the curve for a new product:

1) Established theory

2) Central process ownership guidance/policy

3) Demonstrated performance.

As part of a policy of keeping this data relevant and topical, I have encouraged regular reappraisals of the available data to test for statistical significance and draw conclusions about the best way of approaching the next launch. Standard chi squared tests on the demonstrated/multi-product data range show that both the favoured planning curve (80% learning over 50 sets) and the standard process favoured curve (85% over 100 sets) are weak approximations of the actual data, and it could be considered statistically unsound to use either curve.

As the data is reflected upon, it becomes clearer that of the two learning curves, the 85% over 100 sets curve has a slight advantage over the full range, but with the significant disadvantage of underestimating the critical early build sets. This was true of the earlier more manual/metallic products, but the data match for more recent carbon/automated products weakened further. Separate tests showed that an 82.5% curve over 80 sets provided the best approximation of the learning, but at a delta to the set 100 maturity value of between x1.25 to x1.3.

When the assumptions are adjusted for this factor at set 100, the match improves considerably and aligns better for more recent launches, but still misses the mark on early (first 10 sets). This observation leads us to a consideration of the **reach, use and impact** of this data. I roughed out the figure below as a way of testing significance and establishing context in three zones of a typical learning curve:

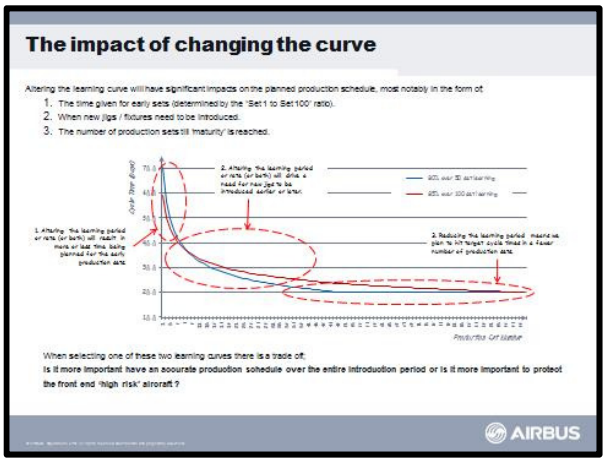


Figure 25 Three distinct phases in reading the significance of a learning curve

Source: A statistical review of learning curve models – October 2014 – Bailey, Barnes & Ellis

There is a high degree of significance attached to how to proceed in using this information. So, a little discussion now follows on the significant uses to which the data can be put and why getting this right is so important.

The impact of selecting for the right cycle time learning curve is felt in the three phases of the curve, as follows:

- Estimating the crucial early builds at the **top of the curve** when all the milestones are political and public, as well as technical
- Establishing reliable cost targets in the **middle of the curve** for capital investment in jigs, floor-space and tooling as the programme ramps up
- Achieving the expected manufacturing maturity at the **end of the curve.**

As we have seen, there are a number of competing views that demand consideration when setting up the planning for a new product of any complexity and scale, and decisions here have far-reaching impacts on initial business cases, running into the hundreds of millions of euros, and on subsequent returns on investment and risk. More tests were done to evaluate the scale of the impact occasioned by selecting for different learning behaviour, and revealed that switching between an 80% curve over 50 sets and 85% over 100 sets could cause fluctuations of 12 months in critical set 1 out-turns of four months and jig introduction points in the ramp-up.

This leaves a series of **moral/ethical dilemmas** to be resolved. Should the set 1 cycle time be rated as more critical than the expensive ramp-up phase? Why would planners not follow a standard curve? Or, then again, why would planners ignore demonstrated performance?

A theoretical approach for thinking about this emerged as a blend: **a compound curve**.

1) With the **top of the curve based on demonstrated performance** that best reflected the likely impact on the most vulnerable first product builds.

   (80% over 50 sets)

2) With the **middle of the curve derived from the most statistically significant best fit** from the bulk of the data that will go on and drive the ramp-up related capital investment decisions.

   (82.5% over 80 sets)

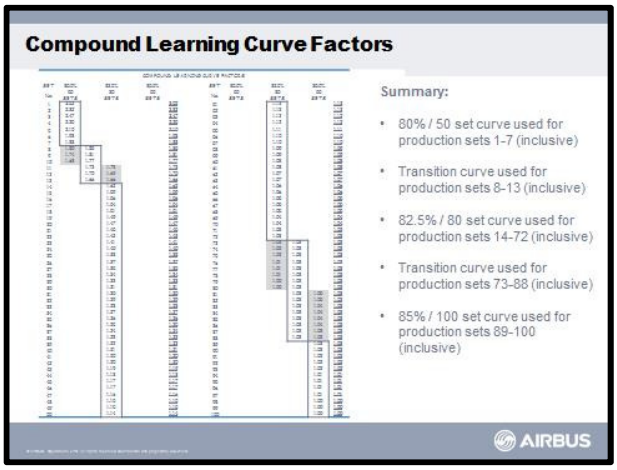
3) With the **end of the curve reflecting standard guidance** for convergence to the engineered cycle at maturity and ongoing RC calculations.

   (85% over 100 sets)

4) With a **load factor** of x1.3 applied to the convergent set 100 target conditions.

This compound curve is captured as a table (Table 5) and as a graph (Figure 26), and can be viewed as the optimum trade-off between all competing claims for the **structural** build of new products. Equipping, specialist work phases and derivative launches have a similarly well-argued rule set, but with different outcomes.

Table 5 Compound approach to expectations from learning curves



Source: A statistical review of learning curve models – October 2014 – Bailey, Barnes & Ellis

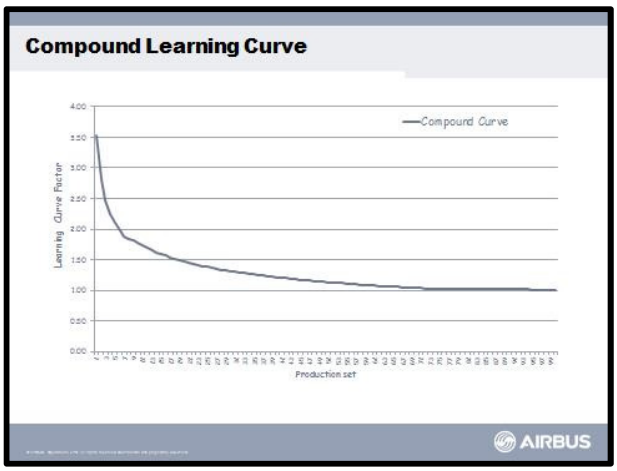


Figure 26 Derived compound curve blending 80/82.5/85% curves

Source: A statistical review of learning curve models – October 2014 – Bailey, Barnes & Ellis

What this knowledge allows for is a considered approach to expected outcomes that can be bridged to from standard assumptions. It helps in avoiding the pitfalls of planning just to the book, at the outset or, if adopting the standard model (85% over 100 sets), adjustments can be made to bridge to or mitigate expected deviations where demonstrated behaviour suggests that this risk is at its highest. Sharing this knowledge within the planning team, **capturing new data and keeping the conclusions fresh** are all part of ensuring that team members are equipped to think about and commentate upon options at the most critical point in the product life cycle. This is often early on in a launch programme as learning curve decisions often arrive quietly, early and unnoticed, when teams are small and they are away from the spotlight, but become deeply embedded

in the logic affecting many facets of ensuing business cases. These assumptions then grow in significance over the next five to seven years of a full development cycle. What starts as a rather dry piece of ME planning or estimating data slowly escalates into national commitments that will sit at the heart of later challenges to deliver products in line with the plan.

This compound curve discussion should be viewed as **an example** of the kind of knowledgeable guide that may be produced when the organisation has been set up to retain planning knowledge and deploy it in roles that can be heard.

4.2.2 Importance of governance templates

Whose plan is it?

Is it driven by a central function (who'll want conformance with central rules)?

or finance (the lowest RC – staffing-hours, and shortest cycle – inventory)?

or shareholders (smallest factory impact and best return on assets deployed)?

or final assembly line (most reliable indicator of delivery dates)?

or programme (who'll want the lowest number of jigs and risk)

or plant (an achievable plan)

or HR (the best indicator of headcount, timing and training needs).

Planners could centralise the plan and conform to standard templates and someone else's rules, with little local ownership, but this can lead to planners merely accepting rules as cascaded to them, then executing their task in line with instructions, in a sort of 'fire and forget' planning. This reads far beyond learning curves, and is about the kind of model planners elect to run organisationally. But to follow the 'fire and forget'/work to a template approach to the *n*th degree can lead to a model where one could centralise the planners, maybe put them in a single room, divorced from the products they plan, and cover the task at a cheaper/lower operating level than a locally devolved 'thinking and acting' model. **They would be experts in the system only, not in what the data tells them. '**Good', here, would look like compliant task execution,

on time, with plans cascaded in 10 days or less with a top-down cascade of requirements to agreed rules with standard operating roles across all areas. By contrast, a planning leader could localise the plan with separately located teams, embedded with the products that they are planning, tailoring the plan to local conditions, securing ownership and actualised in line with reality, but this drives complexity, variation and starts to become the planners' plan. Alternatively, planners could opt for a blend – a best of both – which is what I established with the integrated COC approach.

It is possible to aim to meet the **TLRs with local adjustments** made to secure reality and local buy-in, but this requires mastery of the data, understanding the likely learning behaviour to be expected on a product in this factory rather than a nominal section somewhere in the world. Non-standard cycles can then be catered for to flex for local school calendars/jig conversions, learning curves can be bridged to expected values, and so on. To allow for this 'best of both' approach to flourish, there has to be enough well-understood local knowledge, backed by robust data and stakeholder visibility, to be seen and **enough governance exercised** to prevent complexity from overriding the benefits.

I have pursued an integrated planning approach to this: but it is off blueprint in the way it tackles these trade-offs. A next step is to use this research to further the visibility of the merits in this approach. This is one of the gains I hope to make from this doctoral process: a personal clarification of the linking narrative behind an integrated approach to 'ways of working', knowledge dissemination and tools/techniques deployment.

The approach that I have developed is a blend that positions planning so that it is neither operations-led (and open to optimism bias in reporting) nor plant programme-led (and open to compliant plan bias), nor centre-led (and open to a remoteness charge), but is rather like a plant-hosted centre of competence or COC. In acting as a COC, but co-located with the products that they are planning, Independence is key, but only so far as it has to be planning by consent, which begs the question: whose consent?

In practice, this means providing the planning back-office 'fire and forget' programme cascade, adjusted to suit local reality, with a multifunctional (MFT)

sign-off to the underpinning rules, prerequisites and assumptions to allow for a clear route back to an annual operating plan. I therefore expect planners to know both what is expected by the company (such as an 85% CT curve over 100 sets) and what is locally acceptable (such as an additional bad weather allowance for January). I also encourage planners to be able to link this planning to what is actually happening with respect to actual performance and the gap to plan, and be able to produce bridge charts to explain themselves and have an opinion on why, supported by facts.

But this approach of locally owned planning in some factories that I have visited can cross the line into 'why did planning do this' and into programme (risk/lead-time/policy) or operations (performance management) arenas. In turn, these show up as clashes over the plan if it is not being achieved (no noise when all is well!). Typical challenges when things are not tracking to plan may include:

1) Why is the build not producing as smooth a labour profile as we'd like? (It has some learn curve peaks built in for derivate first articles)

2) Why do there appear to be more planners in Plant A than Plant B? (Because the roles that they conduct are different)

3) Why are we deviating from the plan? (Because the plan is always a challenge to improve upon past endeavours).

In this complex environment, one of the answers to managing this lies in running a combination of:

1) A clear, centrally coached and measured governance model

2) **Explicit assumptions signed off by those accountable to make it happen**

3) Regular planning 'drumbeat' reviews at product level to help deliver drip-fed coaching on typical flashpoints, and to deal with them at senior head level by securing their collaboration/guidance/ involvement and support.

Part of this management of planning knowledge requires constant coaching and reminders on the precision of language. For example, non-planners may often confuse the following:

AOP
An annual fixed financial planning baseline at cost challenge assumptions

The planning baseline
The customer-facing FAL requirement for build of components

A plan (MPS)
The current volumes of key aircraft sections at currently agreed assumptions

A recovery plan
A tactical route back to the plan, but at different costs (higher overtime, for example)

Tactical plan
A short term, level 1 or 2 breakdown of either a recovery plan or master schedule

A forecast
A projection or outlook, may be one of a series, may be black hat and based on worst case, or yellow hat (most positive) and an independent central planning forecast may differ from a local one.

A target
A stretch goal that is acknowledged to be risky

A commitment
An underwriting at senior level that one of the above will be met

An experienced planner needs to be clear about what is being requested. A **plan** to halve the learning curve as a route to cost reduction is not the same as a **forecast** that this will happen. By way of an example, a request for a recovery plan in Week 30 to show convergence by Week 40 may result in a set of tactical plans being prepared to show a closing of the current 10% performance gap by, say, 1% per week. With an underlying trend of 1% per *month* improvement, a planner asked for a forecast would volunteer a 10-month outlook (not a 10-week recovery).

Signing off that all parties understand what they have asked for is pivotal to keeping control of complexity in this area. The challenge is to be clear and consistent in terminology and to insist upon this in others, gently correcting errors in how requirements are expressed. It is necessary to be equally clear on whom the task falls to deliver the expected improvements. Plant operational leaders should be the ones putting convergence actions in place, not planners, and should be accountable for the result. I would expect experienced/ knowledgeable planners to understand the underlying data and the weight of historical trend information, also to make clear the degree of risk required by the **collectively agreed assumptions**. I would also expect an ongoing commentary on the achievement rate (or otherwise) so that any weakness in meeting the underlying assumptions does not come as a surprise.

But we come back to 'what is a plan for'. I would define it as a route forward from current achievement to a designed set of outcomes at a point in the future. For example, we have built 10 sets of a particular product by the end of January and want 120 by the end of the year. The detail, complexity and variability are all when it comes to describing how this may be met – what shift patterns, calendars, lead-times and learning curves, for example. The knowledge that underpins this starts with knowing and understanding the underlying learn-curves at launch, and the cycle and staffing-hour behaviour that can be expected post-product maturity.

The immediate output of such a plan is a set of dates used to align or meet with customer expectations (delivery dates) linked by rules for cycles and stock that allow derivation back to stage milestones and dates that set waypoints for a worldwide supply chain actioned in SAP. Sub-sets of these plans are the consequential outputs that set employment, shifts and overtime levels as well as cost, inventory and operational performance levels.

As described earlier, these are outcomes with many interested actors and commentators far beyond planning. Planning can either conduct the task to strict rules and shrug, or play a full, multifunctional team role and **act as the fulcrum** in the team that brings this together in an integrated way. I have elected for the latter but, whenever the environment shifts towards the 'less appreciative', it is important to know where planning accountability stops and

others step in. This could be, for instance, where the financial perimeters no longer match the task, the engineered content has evolved away from the planned cycle times or simply if operational performance is not following the learning curve. It can be easy to confuse whether it is the plan that is flawed or the execution, or whether circumstances have shifted and both need reinvigorating. It is leadership, based on knowledge and experience, that sensitively negotiates this moral minefield, aided and abetted by a strong governance template approach and sign-off methodology, as outlined in **public works, section 4.3.4**.

4.2.3 Contribution to learning and practice

Contribution to learning	Contribution to practice
Knowledge retention, sharing, developing, applying (4.2)	
Examples of how an integrated planning organisation may approach some common planning concerns such as managing learning curves and securing buy-off on underlying assumptions.	Real world examples of planning issues and some practical ways of approaching them based upon knowledge, which other planning leaders who are faced with scale and complexity may recognise.
Practical examples of how retained skills in a mini-COC can access knowledge to help lead the debate on key scheduling issues.	A reflection-on-action on how to think about the impact that planners can have, based upon their experience and knowledge. Significantly, the issue of trust is fundamental. How can a planner engender a climate of trust? By being appreciative, collaborative and knowledgeable on method; reliable; with a proven track record; an expert negotiator between floor and management – practically a shaman. When the mythologist Joseph Campbell (1972) was asked to give a paper on psychosis, he said that the shaman and the psychotic both enter the same pool, but the difference is that the shaman knows how to swim. In times of crisis in such a complex industry, it is the planner who needs to know how to swim and lead others through, as well. A contribution to practice and knowledge is what constitutes this ability to swim. Ways of knowing of the planner, and sharing and facilitating these in others, is swimming and teaching others to do the same.

4.3 Tools and techniques

The sections under the general heading of 'Tools and techniques' are reflections-on-action over a number of years that have informed a choice of tools that have proven useful, with significant impact and reach. They differ from standard project management tools and **my impact** here is in the generation of an approach that links knowledge and prior experience: the 'similar to' of Schön (1983) with the 'common sense' of Dickinson (1906) referenced in the context statement. Some of these public works have taken a recognisably conventional form of an argued proposition to change an existing process (governance), while others introduce something entirely new (cardinal rules), and some such as a 'plan-on-a-page' have taken what was an existing process methodology and adapted it to a new application. I have included in this section the opportunity to reflect on issues of acceptance and criticality.

4.3.1 Compression behaviour and cardinal rules

I like solving issues and pressing on to make the link between theory and action that delivers results. Reflection-in-action, coupled with the urge to simplify and draw patterns, peaked for me with the cardinal rules process, as discussed earlier. **This is where the positioning of the role, the knowledge that this unlocks and the tools that can then be deployed all meet.**

The situation that gave rise to 'cardinal rules' as a response was one that will be familiar to many planners, where separately posed questions, from different meetings from different parts of the organisation, all challenge various elements of the key assumptions behind a plan. In the case of NPIs, this challenge is often performed on the basis of seeking to offset upstream development risks, overlaps and slippage. The intent is to do this by cashing in downstream (later) supplier, manufacturing or assembly rules. If this is not controlled, it can often take place in a piecemeal and fragmented manner that makes it difficult to see the remaining picture in a true risk or opportunity context.

If we take a manufacturing assembly perspective, standard **manufacturing planning assumptions** would start with full cycle time, five-day week, standard calendar (i.e. time off for Christmas), time to respect first article goods receipt

processing times and so on. This would set the cycle time that drives a right to left set of milestones for upstream activities to meet such as drawings release dates from engineering and parts 'on dock' dates required from suppliers. So, a good foundation for this process at a major section or component level would be to:

1) Get the manufacturing baseline right (cycle/staffing-hours and learn curve)

2) Build-in an allowance for the known impacts on a new build (goods receipt (GR)/flight test instrumentation (FTI))

3) Have some degree of firebreak and customer protection

4) Decide how early is too early to cash in

5) Make it difficult to cash in, so as to force on- time behaviour up front first

Points 1 to 3 are natural, 4 is a judgement call and 5 had no mechanism.

This, and what follows as my reflection and learning on it, are framed by a multi-company view encompassing many products, parts, sub-assemblies, major sections and airframes. What follows is therefore *not* a specific company issue but appears to be a generic aerospace industrial issue, yet may have parallels in **other areas of industrial practice**.

Reason 5 (making it difficult to cash assumptions) had no rules because:

1) Top-down management in most companies usually wants a compliant plan

2) The political weight behind this is all but irresistible

3) The plan execution is conducted by PMOs who often have:

   3)a An event-only view of the current product under management
   3)b No access to prior demonstrated performance history
   3)c A temporary tenure

4) It is supported by consultants who have been brought in to solve an overlap

5) Everyone has a view of the assembly end of the process: it is tangible, unlike the design bit, which can lack the measures or visibility it needs.

Typically, the challenges to cycle compression are:

1) Cut out the GR window and go to just-in-time (JIT) from set. This may be good for series, but is not appropriate to new products as it ignores the first article inspection, quarantine, missing paperwork and qualification delays that often arise

2) Cut out the customer protection margin, as it is pure non-value added (to whom?)

3) Run FTI concurrently – even though it is frequently complex, late in definition and growing

4) Challenge the learning curve ('the product won't change that much, we will put experienced people on it')

5) 'Put it on triple shift' – to do it now will take two-thirds out of the cycle (in practice, it is likely to be on 3 shifts to absorb the unknown unknowns)

6) Double the manning – even though the critical path will be loaded to maximum density already

7) Work Bank Holidays and Christmas and shutdowns – (again, they will be, in practice, but to deal with directional and temporal complexity as it emerges)

With or without these challenges to core assumptions being embedded at the outset (baseline stage) of the planning, the piecemeal nature of the challenges can be driven by the emergent engineering (design) slip. So, in this case, engineering difficulties in early design trade-offs between weight, cost, stress and so on start to cause schedule lag. As this pressure becomes visible, programme

management PMOs still need to show a 'balanced' plan with no overlaps, and the pressure then builds in order to offset one week of slip in drawing releases by one week of compression somewhere else. This tends to drive the piecemeal nature of the questions being drip-fed into manufacturing and the supply chain. One week, the request might be to investigate the effect of working Saturdays to help shorten the cycle and defer the requirement for drawings. The following week, the request may have shifted to the impact of cancelling leave over the summer period, or the days that could be saved by working full weekends, or triple shifting the assembly areas. A month later, these may be followed by challenges to reduce the learning curve or filter out the impact of installing flight test instrumentation on dedicated FTI days.

This pattern would continue slowly over the upstream pre-production phase until the manufacturing cycle is at full compression, with no opportunity to compress further. The overall project is now faced with starting production with incomplete data and missing parts, and moving from 'green' compliant planning to 'red' risk, right at the critical end stages.

This eventually culminates in one of the launch products that I saw proceeding with around half the cycle time and half the manpower needed, on the basis of these piecemeal challenges being accepted and 'baked into' the baseline. In framing the problem here we could synthesise the issue into a **typical industrial frame generic to suppliers and assemblers** alike, and not specific to any single product or company. It would look like Figure 27:

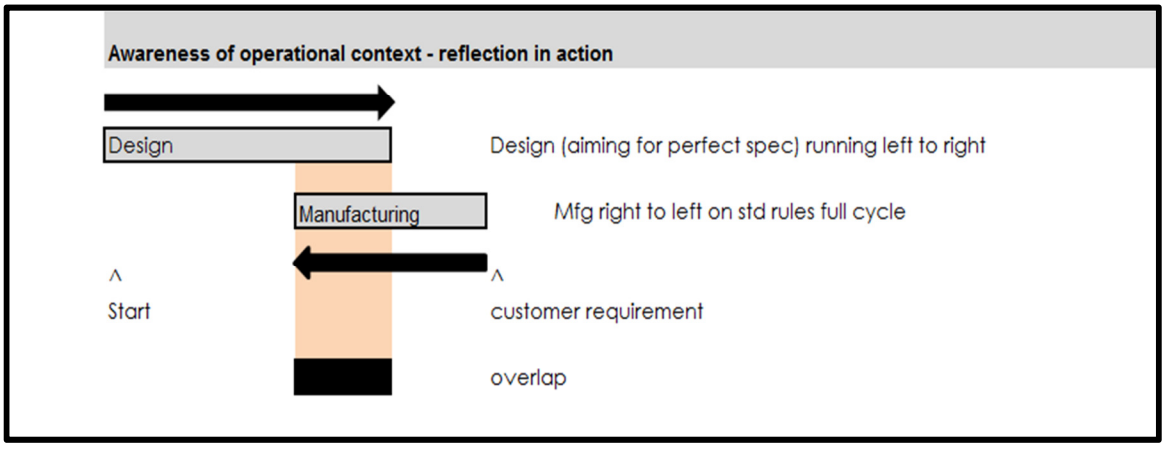


Figure 27 Left to right and right to left planning producing an overlap

Source: DProf submission – 2015 - P. Bailey

The first full left to right/right to left planning exercise exposes the degree of inherent mismatch in the baseline assumptions being used. This immediately breaks the multifunctional (MFT) approach down tribal lines, with 'design late' versus 'manufacturing need' dates. This leaves PMOs and consultants to broker a sensible solution. If all the manufacturing rules were cashed early, it would change the picture at a stroke to:

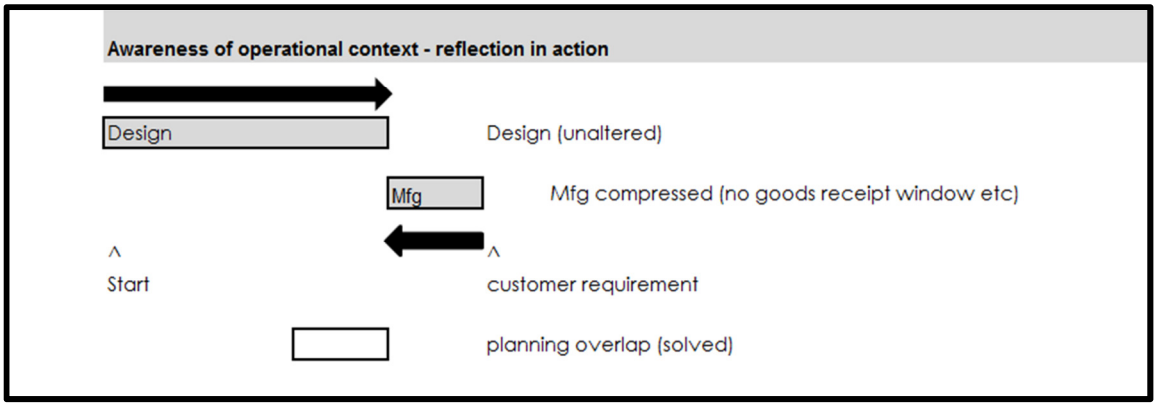


Figure 28 Left to right planning, with manufacturing compression

Source: DProf submission – 2015 - P. Bailey

Then there would be a short period where the plan appears compliant and the pressure eases, however design 'unknowns' begin to creep in, and a typical pan-industry experience would emerge as follows:

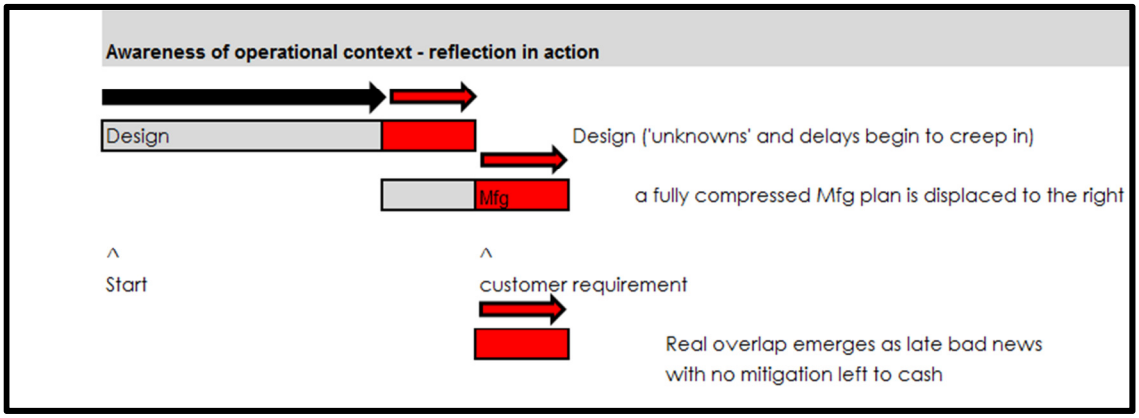


Figure 29 Left to right planning, with emerging risk becoming apparent

Source: DProf submission – 2015 - P. Bailey

In reality, the manufacturing element will have gone through a couple of atypical compression and delay behaviours. First, the green rules of logic and prior experience will have been challenged down to a compressed 'best case',

then two effects come into play. The first is a general failure to meet the prerequisites of underpinning a best case, and there is a **reversion to normal** event or series of events. The next is the impact of any late data/components with an un-cushioned effect pushing delivery further to the right.

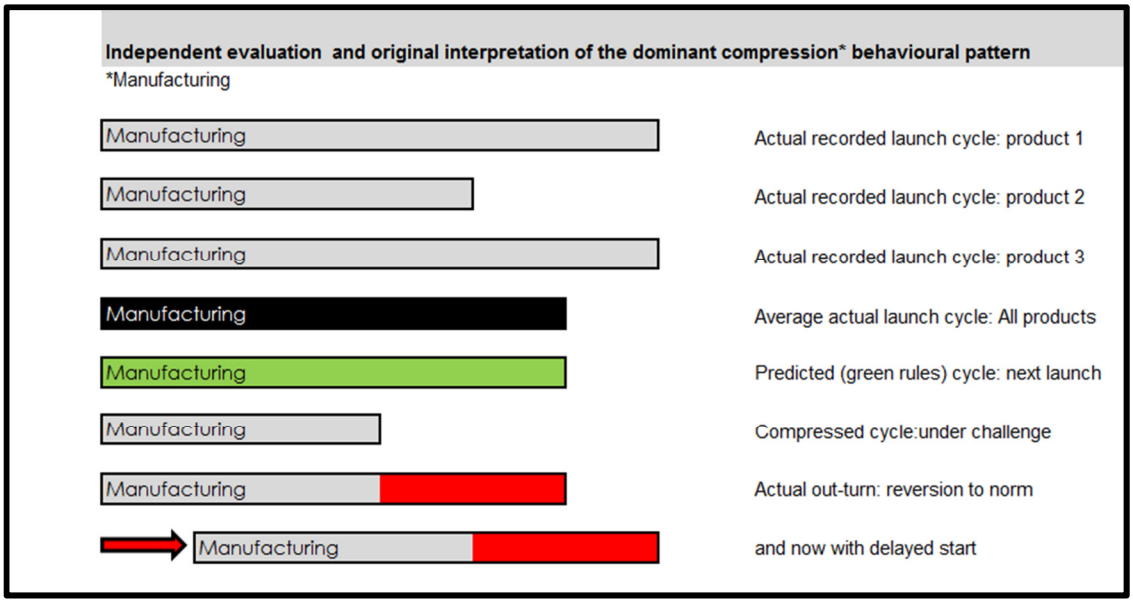


Figure 30 Overview of observed cycle time compression and reversion behaviour

Source: DProf submission – 2015 - P. Bailey

This has been a feature of every major supplier, key sub-assembly, major section and aircraft launch in which I have ever participated in with a variety of companies. The earlier compression conducted under 'yellow hat' (de Bono, 1985: 91-114) reverts to 'black hat' under the pressure of reality. But this is not carried out in isolation or in ignorance about what other suppliers or other sections of the aeroplane are doing: there is constant surveillance of whether they are cashing only opportunity and no risk, judging the degree of risk to put numbers to. No single supplier or section wants to behave differently, out of step with the collective 'group think' on this, so there will be waves of conforming logic. There will be opportunity days, for example, where the sole agenda is to table chances to improve/compress/reduce because, understandably, the aim now is to collectively deliver on plan.

This is how the problem is framed when there are challenges to core logic:

1) High political/consultant/management and programme pressure to conform

2) Piecemeal challenges (GR challenged in one review, shifts already cashed in one component in another. FTI managed separately)

3) Occurs in different sponsors over many reviews and months, at different times and in front of different audiences.

I was lucky enough to be involved with a high-level audit on one of the sections of a product launch that had posted late bad news and posed a risk to the aircraft-level assembly process. This audit concluded that there had been a too aspirational level of opportunity, cashing in the baseline planning, and an unchallenged degree of subsequent compression without due consideration of the accumulated risk. As part of the 'red team' brought in by management to drive a turnaround and return the product to plan, the gaps in the approach adopted were clear to me. It was less clear what to do about it, but the next product to be launched provided a good opportunity to introduce an improvement to this aspect of planning and control.

As the head of department charged with leading the manufacturing planning response, I needed to build on the lessons learned and to find a logical way of countering this behavioural pattern. I also needed to uncover a way to do this in a way that some of the most **significant stakeholders** in the company could respect and support. My thoughts turned to *how* to do this. **The first step was to analyse** all the previous 'cashing in' questions, then to dissect other key contributors to the cycle time debate and establish for all of these facets what any reasonable person would agree 'green' meant (more on this later!). From there, it was a straightforward step to settle on what 'red' might be.

As an example, we could take the shift pattern deployed, green being single shift, amber representing double shifts and red representing full triple shifting (with no contingency left to recover from any shocks or surprises in build). The aim was to capture this all on one page and secure agenda time at the most senior level reviews, in order to present it to the key stakeholders and consultants who often support such headline activities. The idea adopted was to frame the response as follows:

1) Simply

2) Top-down (first in front of the most senior management)

3) As a tool to help protect them from excesses elsewhere

4) On one page

5) At an executive level

6) Using red, amber and green

7) For the product

8) In a way that appeals to common sense.

The message that went with this approach was broadly that planning would no longer cash in on compression activities piecemeal. Instead, they were going to log all requests, debate them at the most senior level, record who was asking to cash what, and why.

The subtext was that planners would inject transparency and accountability into the process, lift it up to a strategic level and make the process more accountable. This process worked very well on the next product launch and was embraced by all the stakeholders as a great way of acknowledging lessons learned from past mistakes.

So the **cardinal rule process** was floated in a way that listed the core elements in a logical order:

1) Is the basic cycle time correct/supported by engineered content?

2) Do the staffing-hours match the budget and the engineered content?

3) Is the learning curve right?

4) Have the plans counted in single-shift working or gone for more?

5) Have holidays been correctly assigned as 'down days'?

Green would be an assumption of normal (single shift) uncompressed running.

The solution was to hold a mirror up to the degree to which rules were being offered up and cashed from green (single shift) to amber (double shift) to red (double days and a night shift). This was not done as a judgement, but as a reminder to log and project-manage the **prerequisites.** This would enable planners to assess that it would be all right to cash the learning curve if the degree of product change did not exceed 10%, for example, or that the GR margin could be cashed in by exception for a small number of critical parts, so long as it was maintained for the volume deliveries.

Effect

1) It remains a great aid to risk-tracking at a practical schedule level

2) It promoted 'can/if' thinking

3) It inhibited rash random and convenient uncontrolled cashing

4) It exerted control

5) It provided an inverse risk bridge to the prerequisites if they were put at risk (planners knew what to add back in, if they failed to deliver).

A reminder was offered that planners would retain this as company data available to auditors post-event, and that they would record, on a bridging chart, **what** had been cashed, **who** had agreed it, and **when**, as well as recording who had been informed of the context of the total 'cashing in' that had taken place. By closing off the opportunity to say 'I didn't know', it affected a controlling effect, making the changing of fundamental assumptions a little bit more difficult.

At this stage, the process remained local and wing-based, but the next steps were to share this with my transnational colleagues. For the process to mature fully and influence a wider set of the critical planning community it needed process sponsorship confirmation at the most senior level and, accordingly, I presented it to international cross-plant audiences until it gained enough traction to be embedded in the requirements of each new product plan at launch stage (see Figure 31).

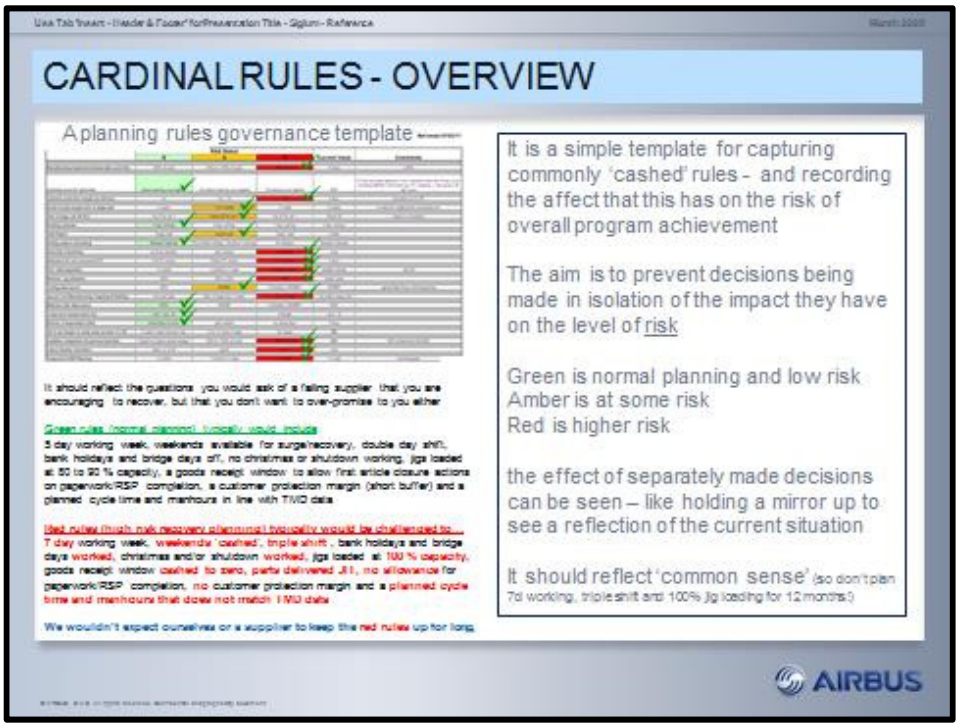


Figure 31 Cardinal rules overview

Source: Presentation to multinational operations forum – March 2013 – P. Bailey

From this, and in particular the sharing of the process with central team colleagues in Toulouse, the cardinal rule set approach began to spread into other parts of the company. First, it did so due to a desire to adopt **best practice** and later through becoming a **planning tool** for all plants when launching programmes. This has since matured into a standard addition to the multi-plant governance guidance issued by the central programme team, and the take-up of this tool's use has now been encouraged further at key suppliers and RSPs as far away as the USA.

By now, I have impacted practice by briefing this subject to hundreds of planners and programme managers across multiple products and plants, as well as partner consultants.

The emphasis has been that the aim is not to plan all green, all of the time, but to think about the accumulation of opportunities that are being cashed and see to it that they are cashed in a controlled way, at the right time, and not to all red – which would be seen as too aspirational. Further, it has been to log the fact that cashing of some opportunities first requires actions (prerequisites) to be in place.

As promised in the narrative, I will now return to some of the very many points of epistemology arising from this example.

Who decides on green?

This is where I must turn and face my understanding of ontology through to the nature of subjective or objective data gathering and the nature of 'facts'. I recognise at the outset that framing the problem can be the most difficult part (Schön, 1983: 40). What is the right answer and what is wrong? Do these two absolutes even help in determining a desirable outcome? What is good in this context? Dickinson (1906: 24), as well, brings a philosophical dimension to this.

If engineers had all the time in the world to solve the weight, drag and space trade-offs inherent in a complex product such as an aircraft and to issue a fully integrated right-first-time drawing set, there would be no time left actually to make, assemble and verify the product, and certainly none to accommodate overshoots or delays. If accommodating as much of this time (schedule demand) would result in fewer mods/revisions and more 'right first time' all of the time, then allowing an extended engineering cycle might be viable. If, on the other hand, an extended front-end just postpones the pressure to resource-up correctly and get on with it at pace, then it would be inappropriate. **There are divided opinions on this.** What seems right at the manufacturing end (protect for upstream delays) seems unfair at the engineering end. What seem right, based on an understanding of prior trends, is to build-in a degree of compressibility at the right hand end of the schedule. The issue is where and when. In an ideal co-ordinated world, it could be at major component or FAL level but, again, at the heart of this is the issue of a choice about **who sets the rules**, who holds the pen, and who has the ear of management?

A key question for those embarking on a cardinal rules approach is to be absolutely clear on **who decides on green,** and how objectively or subjectively they view it. This would be the best way to encapsulate the judgement call at the heart:

Who sets the rules?

What is actually required?

Is it a compliant plan?

Is it a reliable forecast?

Is it an agreed multifunctional team (MFT) target, or

Is it a top-down commitment?

One of the key lessons learned for me here was the difference between responses conditioned by different organisations on different projects. These also occasioned a change in response from me. My philosophical standpoint started positivist (factual and objective), but under peer review and in seeking consensus on how to deal with the actions arising from the cardinal rule set in practical use, I began to understand some of the issues inherent in ontologically framing this.

Reflection leads me to summarise that this **worked very well**, as intended, in an appreciative environment, with a strong sponsor keen to demonstrate that a particular manufacturing unit or supplier had learned the lessons of 'sunny day planning' from previous launches that had run into delay. It was accepted that an assertive stance from the manufacturing part of the business was required as part of the overall project management response to protect the customer from potentially weaker upstream data release schedule adherence. It helped that it was delivered with conviction and confidence by someone who had learned from prior experience, sharing it with others (PMOs and key leaders) who had also had a prior chastening experience.

The receptiveness of the organisation **weakened a little**, and cardinal rules worked less well when delivered to people or organisations or suppliers who were new and lacked the shared reference point of prior launches. The same was true when the task of dissemination and robust defence was delegated to lower levels in the organisation or to others at the same level who may have lacked the same conviction for the process. This manifests itself as being seen as an obstacle to a compliant plan to be negotiated with manufacturing, and seen as behaving in an 'un-teamy' manner.

The **worst response** to the process was in an environment where the political pressure to demonstrate a compliant plan met a change in the sponsoring organisation, whereby engineering and manufacturing functions were integrated under one banner and the potential sponsors had neither a shared background with the associated lessons learned, nor the opportunity to acquire it. Judgement led by consultants engaged to show compliance led to what started out as a cautionary process of holding the mirror up to the cumulative risk taken being turned into a Chinese menu of sorts where green was seen as an opportunity to cash (rather than good)! So effectively, red became the new green.

In conclusion, cardinal rules provide an excellent vehicle for innovative thinking in a practical application at key stages in the development cycle. They have gone on to **influence practice** in many countries, companies and organisations.

I would also conclude that tools and techniques each have an ideal climate in which they might be embraced. For example, on some products the most senior management team were keen to demonstrate the lessons learned from previous set-backs and appreciated the transparency and challenge that came with a red/amber/green single-page risk summary of key assumptions. By contrast, other components, suppliers and products shared no key people from prior launches, had no need to show lessons learned and viewed transparency in a highly political environment as tantamount to stupidity. They did not appreciate the challenge of explaining escalating risk with each change to rules that is necessary to show compression in the planning. Acceptance issues peaked for this approach when smaller (tighter) management teams developed a high risk-embracing approach that they perceived to be threatened by this transparency, to the extent that challenges were seen as a threat to the leadership team's accountability.

The in-company transnational take-up has not been hindered at all by what you may have expected, the 'not invented here syndrome', in my view largely for two reasons. First, the culture of Airbus is strongly transnational and supportive of idea sharing, and, second, the traction has been helped by the core of common sense in this that aids acceptance anywhere and makes it easy to explain in any language.

The approach works really well with the coupled use of prerequisites lists and bridge charts, as supportive tools to be deployed at the same time.

4.3.2 Red reports

I will dive in with 'Why a "red" report?', 'What the purpose was at the outset?', and 'What sort of schedule data are contained within one?'

The title 'red' works in a number of ways. One is really quite simple: standard company templates for all reports at the time I introduced red reports had a blue background, so red stood out as different and ran against the tide, a signal in itself. Secondly, the term 'red' implies a delay/risk/gap or problem to a manager, and that was the intent: **to point to what had not been done, rather than what had**.

The purpose was straightforward. On major civil aircraft programmes the complexity builds up rapidly and the detail generated at the point where data is on mass release (drawings) and parts have entered production, and change starts to be controlled can be staggering. This is the subject of **section 4.4**. Suffice to say here, that with detail being in high demand, the data generated can be very heavy. Typically there would be large numbers of component design and build teams each managing multiple parts to a planning baseline, probably with a recovery plan, always with a current forecast and with a project manager or managers juggling lower level individual discipline and component level micro-plans to support the higher levels of planning. When visiting supplier teams at this stage it is not unusual to be confronted with 'war rooms' plastered from floor to ceiling with micro-plans, risk registers and the sheer volume of information can be comforting but confusing.

Assessing meaning from this overwhelming mass of information can be very difficult. Red reports were born as an attempt to cut through the noise to what really mattered and what would drive key outcomes on in-disputable key lock dates (such as delivery to the customer).

Standard project review processes can help obviously, by summarising everything up by major task suite area in all-day project reviews held monthly. But the nature of these reviews in many companies that I visited at this time

followed a standard pattern: the accountable project manager for each bit would stand up when their allotted 20 minutes or so time slot came up and spend most of the time talking about what the team **had** achieved and a smaller amount of time talking about what was coming next. The whole process was seen to some extent as an obstacle course to be negotiated each month without knocking anything over.

The evidence that the component supplying project managers elected to draw on was variable to an extent, with some talking to photographs of components under construction, others referencing the S-curves from their recovery plan, some referring to the S-curves for data as a recovery plan when in fact they were a forecast that had not been bought off downstream and so on. It was also clear that some team leaders were risk averse and captured all likely outcomes in a fairly alarming outlook that they would then go on to better whereas the snowboarding risk takers in the teams would predict ok at the end on outlooks that were clearly unlikely to be met. What I set up in red reports was simple.

1) A fixed limited senior exec level audience

2) A copy to the company up a level (their bosses)

3) A frozen baseline that I maintained centrally as an antidote to recovery plans getting mixed up with forecasts or baselines

4) All authored by one small 'independent' planning team.

The schedule data contained within a red report was:

1) A reminder of the key schedule dates (eg: baseline start on 1 April, finish on 30 July)

2) A limited range of key components (less than 100) to focus on what mattered most: simply split into structure and systems

3) A specific focus on easily understand component sets such as ribs or spars

4) A volume S-curve chart for everything else

5) A straightforward factual count on what had occurred to plan and what had not (parts received, for example)

6) In a format that you could explain to a 10-year-old

7) Data in brackets as a proxy for integration maturity (see Table 6)

8) Remain to do charts (focus on what had not been done and when it needed to be done by)

9) An independent (me) trend line showing whether the achievement rate supported the key programme requirements or not (see Figure 32)

10) A commentary that stated this in black and white (see Table 7)

11) A trend view of how the outlook had changed over time (see Figure 33)

12) A summary at the end of the red report on the level of outstanding work predicted if the product or component was to be shipped on plan with an alternative view on how many days/weeks delay would be needed to ship complete (with no outstanding work)

13) A list of senior level committed actions to improve the outlook (what, by when, who, why?).

The goals were straightforward really: **drive for simplicity**, cut through the mass of data to what really mattered (had what was left to do, had enough pace behind it to close out in the time remaining or were senior level actions, such as resourcing or re-prioritisation, required). Properly applied, it was an acknowledged and appreciated success in making sure leaders stopped avoiding the inconvenient facts, and it did this without competing with complexity but by offering an alternative to it.

At their peak during one of the major product launches, **senior level weekly reviews** were managed by this independent planning review of the red report, as a prelude to going into wider project issues. Below are examples of the specific content included in red reports for major new launching products:

- Figure 32 - Product outlook **scenarios** summary
- Figure 33 – Reported **delivery risk** evolution
- Table 6 – Brackets **volumetric** outlook
- Table 7 Product outlook **conclusion**

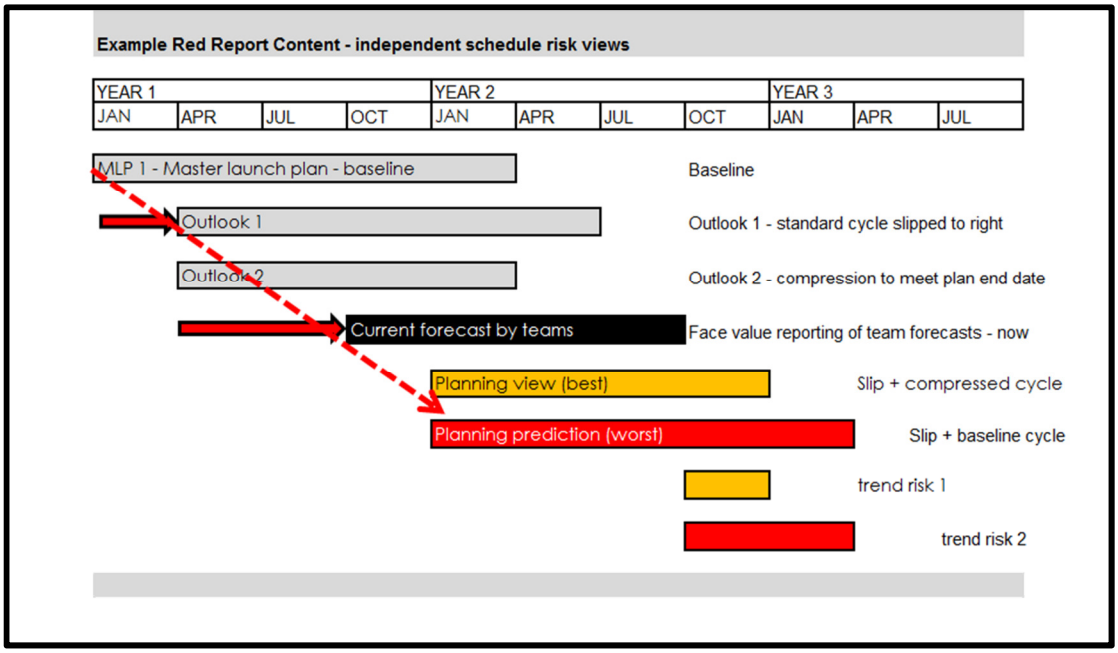


Figure 32 Product outlook scenarios summary

Source: DProf submission – 2015 - P. Bailey

What this chart can offer is an **alternative way of viewing** outlooks. So, if the current official team view at the time is based upon a static outlook, where all forward 'slip' in dates would be halted and that a compressed cycle would be met, the risk that this chart helps to highlight is that if the 'slip' rate continued for three more months, and the predicted cycle reverted to its uncompressed norm, then the probable schedule risk (red) would be a lot higher than the data reported by the teams was drawing attention to.

The management actions then could be focused on stopping any further milestone drift (trend) and securing the compressed cycle through planning to meet the **prerequisites** needed (such as laying on additional shifts). The format described above is still a one month only view, and it was supplemented in red reports by a rolling trend view, updated on a monthly cycle. These **reported**

delivery risk evolution graphs helped by identifying patterns of risk visibility over time and gave context to the reported risk.

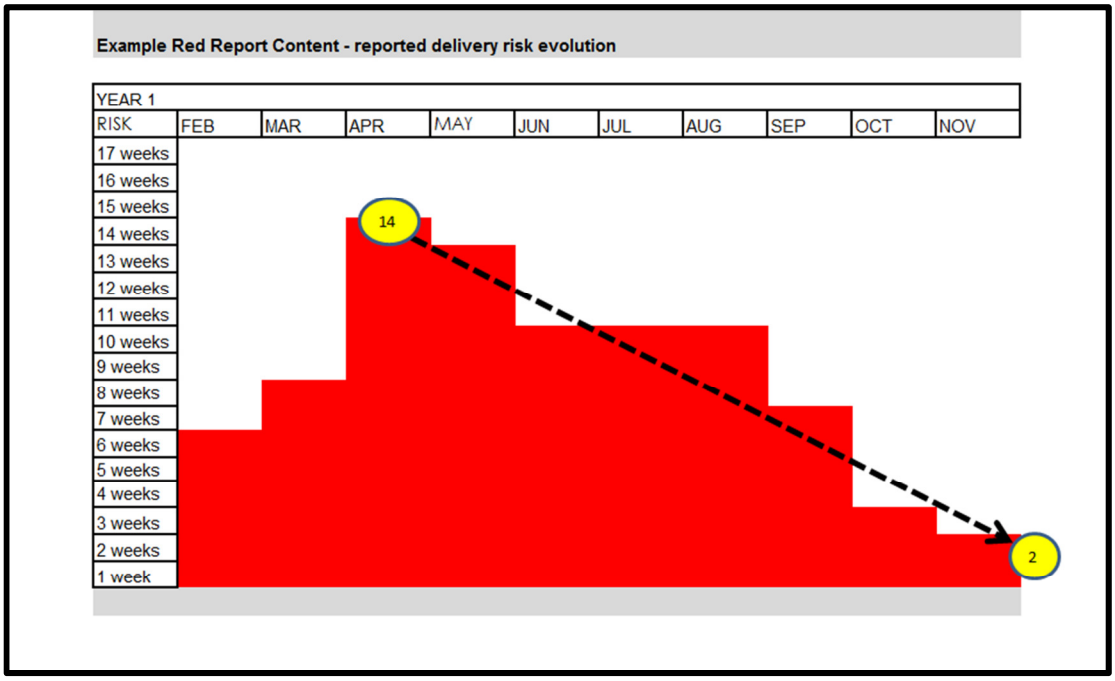


Figure 33 Reported delivery risk evolution

Source: DProf submission – 2015 - P. Bailey

This simple visual helped track the reported risk to delivery based on the agreed outlook.

The theoretical example shown illustrates the risk having peaked at 14 weeks late to plan reducing to a residual view of two weeks late in the November outlook.

One of the other counts that planners used to escalate into the red report pack on early products to some effect was bracket count. It actually sits awkwardly alongside more strategic level zero summaries as delivery outlook for the entire product chain, but the logic was good, as **brackets are a proxy measure for system maturity** and design integration.

They are small almost insignificant parts in the overall scheme of an aircraft project, but they are the point at which the system's needs (electrical cable looms and pipes for example) need to be mature enough to interact with space allocation models on structures to know for example where these systems will be routed through the trailing edge. This is a bit like the Pale Blue dot explanation

(Sagan, 1994: 78) of how the voyager spacecraft looked for the presence of lights on the dark side of a planet and the existence of methane in the atmosphere as an indicator of life. Planners measured brackets drawn and made as an indicator of system integration and design maturity. A simple table sufficed. (See Table 2).

Table 6 Brackets volumetric outlook

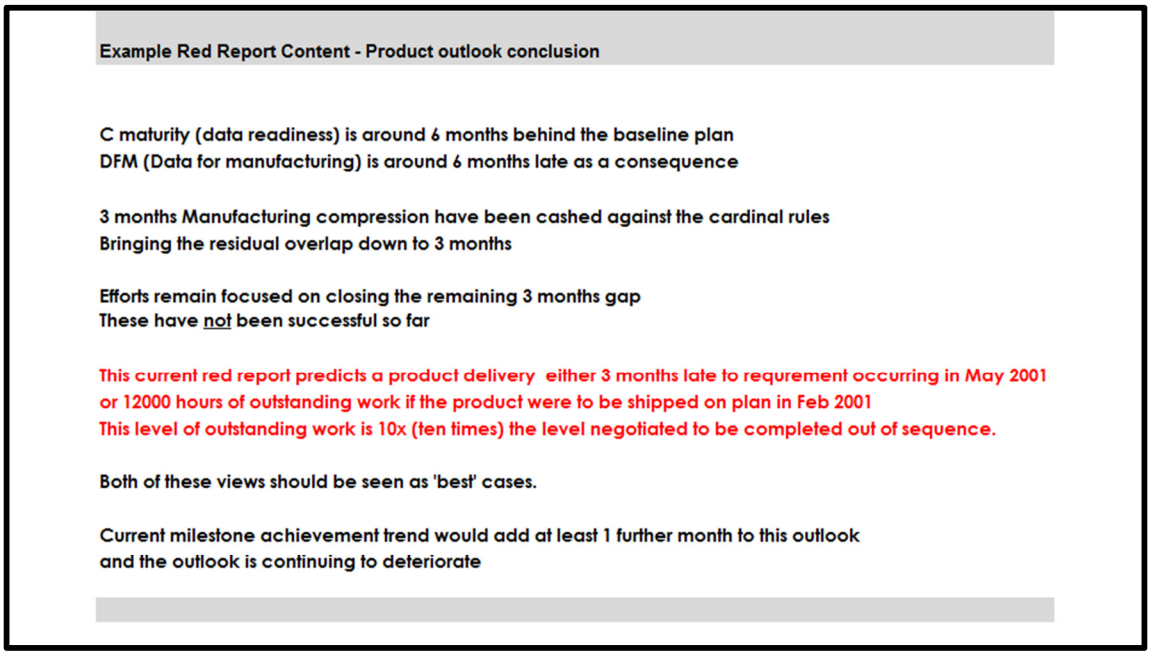
Example Red Report Content - Brackets volumetric outlook

Structural brackets	PBOM	Required	delta	DFM	Received	delta
Leading edge	50	50		50	0	-50
Trailing Edge	50	150	100	150	5	-145
Top Covers	50	50		50	10	-40
Bottom Covers	50	50		50	10	-40
Ribs	50	50		50	10	-40
Total Structure	250	350	100	350	35	-315
Systems brackets						
Fuel	100	100		100	0	-100
Hydraulics	100	100		100	0	-100
Electrical	1000	2000	1000	2000	0	-2000
Pneumatics	50	50		50	0	-5
Total Systems	1250	2250	1000	2250	0	-2250
Grand total	1500	2600	1100	2600	0	-2565

Source: DProf submission – 2015 - P. Bailey

This sort of very simple visual summary (a delivery outlook, a history of how the outlook had changed over time and parts volumetric) would be supported by what was often the most hotly contested part of the red report, a **one page executive level summary** in simple bullet points.

Table 7 Product outlook conclusion



Example Red Report Content - Product outlook conclusion

C maturity (data readiness) is around 6 months behind the baseline plan
DFM (Data for manufacturing) is around 6 months late as a consequence

3 months Manufacturing compression have been cashed against the cardinal rules
Bringing the residual overlap down to 3 months

Efforts remain focused on closing the remaining 3 months gap
These have not been successful so far

This current red report predicts a product delivery either 3 months late to requrement occurring in May 2001
or 12000 hours of outstanding work if the product were to be shipped on plan in Feb 2001
This level of outstanding work is 10x (ten times) the level negotiated to be completed out of sequence.

Both of these views should be seen as 'best' cases.

Current milestone achievement trend would add at least 1 further month to this outlook
and the outlook is continuing to deteriorate

Source: DProf submission – 2015 - P. Bailey

Now for some personal epistemology/reflections on what worked well and what caused pause for thought in this process of delivering often unwelcome news.

Like cardinal rules elsewhere in this submission, it was very important to have strong senior level sponsorship behind red reporting as key to making this work was the establishment of and continual reinforcement of an appreciative ear. What I learned quite quickly was that in 'holding the pen' for this critical subject, it paid to telegraph the conclusions well ahead of each publication to give time **for stakeholder management** to run its course. It helped **to be right** and to be able to dominate the facts behind the conclusions. It helped to be able to build upon an **existing track record** of being right on the big challenges previously. It helped to have good record keeping from previous events to show **prior learning** in this area, and it was essential to have a 'big' sponsor to act as an umbrella when it did rain occasionally.

The process of revealing potential bad news has to be pulled; or heavily sponsored: it cannot be pushed. Without a strong pull, it shrivels at first scrutiny. So, **speaking 'truth' to power** needs an appreciative audience. You also have to **earn the right to comment**; through getting the underlying planning data perfect, as people in glass houses really should not be tempted to throw stones. It clearly

wouldn't make sense to be using flawed and repeatedly discredited data to draw difficult conclusions about someone else's area of accountability. Just as important was **getting the timing right** and sensing how the humour or mood had reached a point where sponsoring red reports felt like answering a complexity problem rather than just adding one more view to a complicated array.

Humour and **metaphors** do help with the delivery, such as describing people as snowboarders with respect to their attitude to risk, as I believe it showed the underlying human nature of the delivery agent. However, smiling while delivering bad news is not to be encouraged. It was helpful too, to be able to demonstrate the linking of information distilled from complexity to practical actions and likely consequences, as **an antidote to information for information's sake.** This had to be secured at the most senior/executive levels, and their encouragement to cut through the noise and present a view that could be used to drive actions helped deflect criticism about oversimplification or the choice of some blunt messages on lack of progress. So, it was important to have protection from critics when the message became more and more uncomfortable. But if I were to pick one point that links my reflection-in-action (at the time) with reflection since as part of this research work, it would be the **ontological revelations** uncovered by coupling suggested reading with observations at the time of use.

One personally significant learning moment with respect to the application of red reports occurred when I sensed more and more strongly that the design team (engineering in one company) response to this reporting was becoming increasingly disengaged. So I asked what it was that I was doing in either the construction of the report, the drawing of conclusions, or the voice-over that went with the material that was generating such a level of frustration. And over coffee and a series of patient explanations, I had an insight to wholly different **senses of being** on the project. A shortened version of what was revealed for me would run as follows.

The perception in the design end of the business could be that my whole sense of being on this project was by necessity conditioned by my plant based/manufacturing sponsored perspective. My ontological standpoint was therefore skewed. The reporting was therefore subjective and **conditionally biased** against design in its construction. Building upon this perception of the

process bias and reinforcing it was language as simple as reaching for descriptions of the drawings released as 'only 50%' of the requirement. We all agreed that drawing releases were a key enabling step that required commentary, but the word '**only**' implied negative judgment. A better alternative was suggested along the lines of letting the facts stand unbiased, as fifty released in 100.

The use of red to highlight gaps and missing activity was also seen as confirmation of a manufacturing (end)-led negative commentary on the design (initiating) end of the same process.

On these two points it was easy to agree to soften the stance just a bit and let facts stand clearly on their own merits (do not say only), and to highlight key parts of the commentary with an eye to a choice of colour other than red. What was more of an eye-opener was the entire premise behind a fundamentally **different ontological framework**. I was clear in my 'preferred existence domain' (Jacquette, 2002: 8) on this project. The scheduling objective was to support an aircraft assembly program by delivering major sections of airframe on time and complete so that everything downstream could follow on in line with the plan. Therefore it made sense to track the enabling steps leading up to this (drawings, parts, sub-assemblies, brackets…. etc). And it followed that deviations to this frame of reference were red/only and 'wrong'. This was 'common sense' to me at the time: and caused me no conflict at all. But in what I still look back on as a hugely significant piece of personal learning, a very senior and well-respected leader in design engineering was good enough to take the time to sit me down over coffee and patiently and clearly explain to me a radically different ontologically framed viewpoint that guided him.

In much better words than this he debunked my 'commonsense' and suggested that it focused on entirely the wrong aspects here. Why spend so much energy on the insignificant milestone of transferring large sections of product to France when what really mattered was taking the time to mature a design that optimised the weight/drag/stress performance for an aircraft that would safely and fuel efficiently carry millions of passengers at a height of 7 miles above the earth for a period of around thirty operating years? Wow! An utterly different way of framing not just red reports, but all launching product perspectives had just

come into view for me. Now I had a choice, and I had to go away and reflect, adjust and decide.

Summary
In the end, the red reports continued. The language was checked by me to remove obvious bias, and the sensitivity to alternative ontological perspectives was acknowledged in a slightly moderated voice-over. But although risk and the perception of when too much is being taken on really does depend upon who's side you are on, Programme level risk is everybody's concern. Selecting what to measure (and what to omit) will always be contentious, but the key aspect here is a mutual acknowledgement that what is being shared in outline is a fair representation of the whole picture.

It is important to acknowledge the static gap that everyone will see, but also offer an interpretation of the dynamic trend that sits behind the evolving static picture. Used well, this approach can avoid the standard green, green, green, red reporting where shocks emerge late and beyond the point where useful actions can be put in place to pull the situation around. These red reports have impact through seeking to simplify to engage and **simplify to place actions**. Born out of the visibility that comes with an integrated role perspective that deliberately stands apart from other functions and has earned the right to comment through a track record of getting the judgement aspect right.

4.3.3 Plan-on-a-page

This is an example of transferable knowledge being borrowed by me from one source and after being adapted for aerospace, being deployed in a different setting. I used this approach to distil mass data into one simple planning reference frame. This allowed for management to concentrate on the most likely outcome or outcomes out of a large range of possibilities and to highlight where management attention was most needed.

Before my intervention here, managers would need to browse through many layers of reporting information in formats dictated by the tool set selected to perform the tracking (such as Microsoft Project) and filter down to what was key with help from a voice-over. My intent here was to focus in on 'key lock dates' for a cross-functional and transnational mix of building, ordering, product,

engineering and parts milestones in one easy to view plan that took the viewer from the order placement through new facility build to the output of the first article in one sweep. This new approach contributed differently by working backwards from what executives and leaders might wish to focus on (rather than what planners in separate functional groupings may or may not have captured) and by establishing context and relevance to which key events to track in a complex setting. It did this by focusing on the '**the lid of the box approach**' like a jigsaw puzzle. So that the neccesary complexity may lay beneath, but that there was a coherent view of how the finished puzzle may appear at all times.

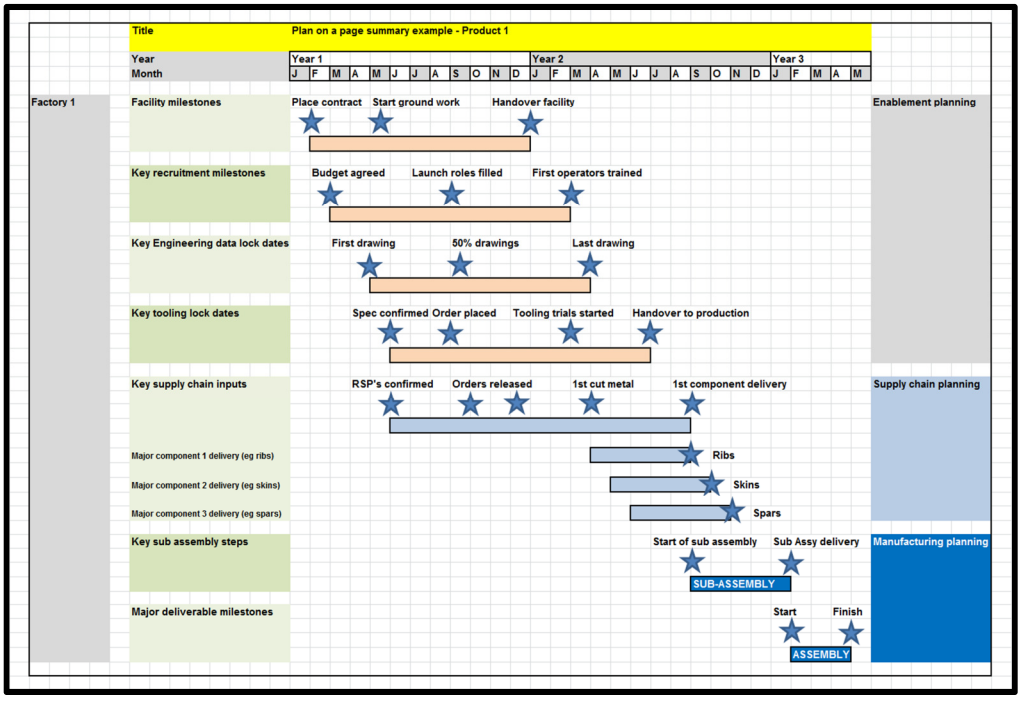


Figure 34 Example of 'plan-on-a-page'

Source: DProf submission – 2015 - P. Bailey

A plan-on-a-page can either stand alone as a useful adjunct to the standard reporting suite, or, with the addition of more statistics plus an appropriate commentary, it can evolve into a full red report. Inputting progress data and using terminology precisely is also part of the art of deploying this approach. It is possible for example to update the static plan of what should happen with a series of dynamic inputs to draw out some conclusions about the risk to delivery at the end. Indeed that is the purpose of putting up just such a planning navigational tool, but there are a number of possibilities here, starting with the least controversial which is inputting a straightforward gap on actuals for events

in the past (event A occurred two weeks late for example). At the other end of the scale is the more debatable (opinion-led) Event X is likely to occur two months late, based on trend, even though the milestone owner insists that he or she will recover the current slippage in the time remaining). So what to populate the plan with and being precise on the source of forward dates is very important, so that the appropriate challenge to what is being shown can occur, and outlooks can be ascribed a likelihood by the viewer.

This choice of facts and application of critical thinking by the planner if left unaffected by political and local ethical concerns would usually be advised to build up as follows. Past event facts first, future events based on reported 'forecasts' authored by the event owners tested for logic against records of previous past performance for similar events and the current demonstrated performance (trend) run rate.

There are **several challenges to acceptance** here, but chief among them is to gain agreement on the deployment of the approach. This is where strong sponsorship on the goal and the importance of directly commentating upon it are important along with getting the timing right so that the data is welcome. On this point, it helps to launch these plan on the page reports in advance of any issues arising or slippage developing rather than commentating on a car crash when the vehicle has already begun to skid. It can be a challenge as well if the planner can see the problem but can not necessarily point to an answer, but on the whole, this approach has been received well wherever I have seen it used as a welcome antidote to complexity that helps management view events in context and perspective.

My impact here was in applying existing knowledge in a new setting. Specifically, I took and adapted other industry practice that I had seen first-hand at British Airways fleet maintenance in Heathrow, and something similar at Lufthansa service planning in Frankfurt and adapted it for application in wing build at Broughton, a process of knowledge transfer from one domain (customer fleet servicing) to another (operations planning).

4.3.4 Prerequisite lists and sign-off packs

My **influence on practice** here was in recognising and implementing a change to planning that recognised the shift in personal engagement that comes from encouraging participants to 'sign up' to some clear assumptions or prerequisites. This takes a plan from the abstract to the real for people, and had the benefit of significantly reducing the noise levels around new plan releases by focusing everyone on a result *before* a plan gets committed rather than having a frustrating debate on any unforeseen outcomes afterwards. In this way, my impact was in moving the scrutiny to the right side of the point of implementation of a plan.

Prerequisites lists and core assumptions for building up a master production schedule, or a recovery plan **are used alongside the cardinal rules approach** to clarify what needs to happen by when to secure a schedule result. The situation used to be that the planners held all of this knowledge almost as a static/implicit rule base to which alterations would be made upon request. Sometimes these requests would be logged, sometimes not, and the net rule set was rarely displayed. What I encouraged here was a formal buy-off pack that included a sign-off sheet and clear capture of all the significant assumptions and or pre-requisites that underpinned the significant master programme releases. This was later successfully extended to cover recovery plans as well. This governance approach was coached in through several internal publics work papers (see Figure 35).

What this approach does is make the link between who the planners have informed and what has been agreed so that there is no surprise at the resultant cost outcome, stock profile, inventory exposure, capital investment plan and similar that underpins the result. It moves the plan from being the planners plan (such as a black box that only they understand) to a transparent multifunctional team sign-off on a collective plan. It also allows for **iterative improvement** a step at a time on any disputed assumptions/prerequisites that repeatedly fail to come true, and root cause analysis can be directed at the highest leverage assumptions (such as manpower performance) that need underpinning by agreed actions. They in turn can be logged as prerequisites. So for example it would make sense to agree which projects owned by which individuals need

delivering by when to allow more build to happen without more heads or overtime being deployed. It is then easy in a controlled way to point to the schedule or cost implications if these assumptions are not met without it being countered by 'I did not know' as the signature loop prevents this selective amnesia.

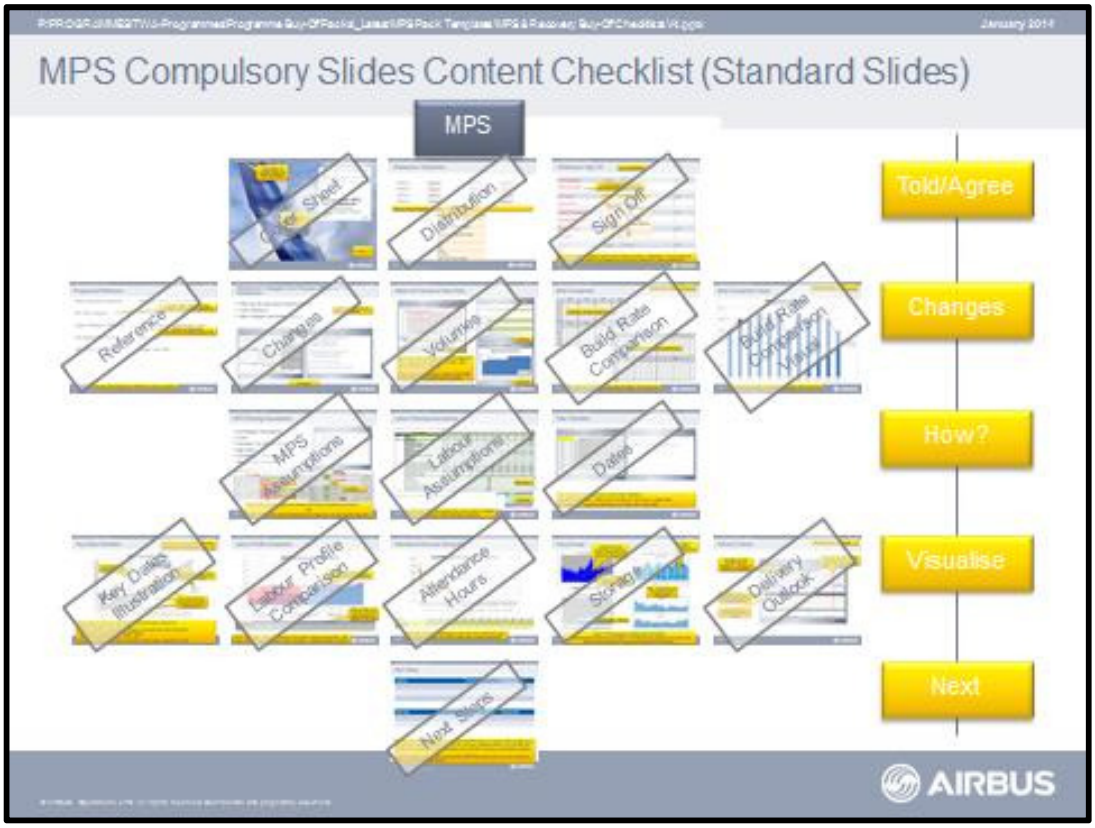


Figure 35 Sign-off pack content checklist

Source: MPS & Recovery Buy-Off Content Checklists V4 – February 2014 – Bailey & Parnaby-King

In this way, using team agreement to simple cardinal rules, linked prerequisites and physically signing off on them lifts the plan from being a technical/administrative planner's only plan to being a cross-team commitment to making the planned incomes/outcomes come true. Most large industrial plants that I have visited still issue plans as a rather dry date tab plus a Gantt chart, whereas **I encourage the release of a standardised and simplified buy-off pack that brings meaning to the data.** By bringing to bear the knowledge planners have and by standardising it across all the products they can swap skills without encountering the 'it's not like that here' issues that prevailed before and indeed still does in other teams that I have assessed in other parts of this industry.

This then is an example of the **accretive effect of an integrated approach** to planning.

4.3.5 Contribution to learning and practice

Contribution to learning	Contribution to practice
Tools and techniques (4.3)	
A consideration of some of the ontological, philosophical and hermeneutic considerations inherent in developing and applying tools not only to drive actions in complex scheduling arenas but to provide devices for integrating disparate parts of a system	A clear description of a combined tool set of cardinal rules, red reports, plan-on-a-page and sign-off packs to navigate complexity with simplicity. Tools and their application in the context of complexity are the artefacts required to navigate complexity, much like a compass or its successor, GPRS, is necessary for the safe navigation of ships and other vehicles. Tools are ways to get to the destination safely and on time. The tools are in themselves repositories of experiences and knowledge reshaped to be of practical use. Thinking clearly about the role of the planner in complexity I would suggest that one of their roles is the development of such tools. The ones in this chapter are examples of what can be created to both capture knowledge and apply it.

4.4 Layers of complexity

4.4.1 Presentation to University of Oxford, Saïd Business School

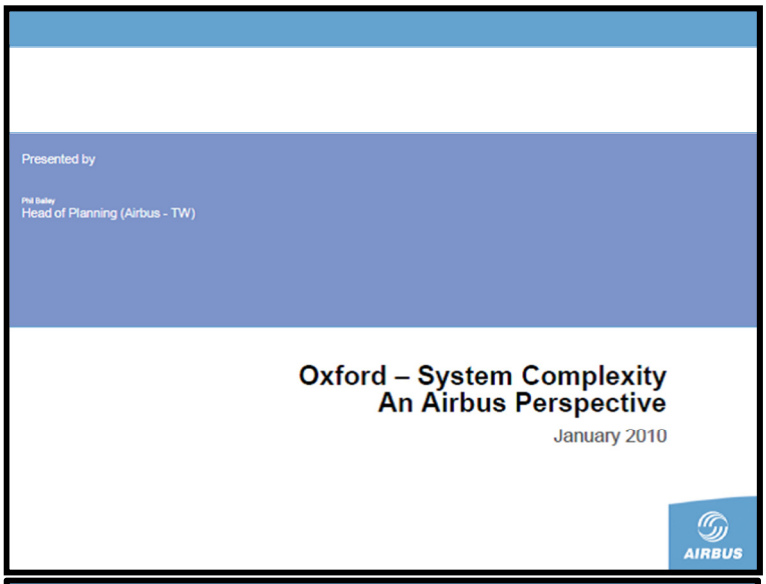
This presentation is on the accretive nature of the four types of complexity (Rimington & Pollack, 2007: 89) in major aircraft programmes**. I prepared and delivered** it to the MSc Major Programme Management in Systems Engineering cohort at the University of Oxford, Saïd Business School, in January 2010. It encompasses structural complexity accruing from multiple interdependencies, technical complexity from design and decision making, directional complexity from potential conflict over goals, and temporal complexity derived from the expectation of dynamic delay and change.

The full set of 63 slides used in the delivery of this lecture follow, although in the interests of brevity they do not feature in the list of figures at the start of this thesis. They are included here to establish context and as an example of a full public works paper that I have prepared, had approved and used, and it is usefully similar in nature to all the other public works referenced throughout this submission.

The preparation of this particular externally used piece of published work allowed me to confront my understanding and reflect upon my core beliefs. It let me test them against a wider business audience and gain peer approval for their release into the public domain.

I learned many things from this process, such as that large companies may not encourage public discussion on competitor product behaviour; I had wanted to include comparisons of the impact of complexity on other aircraft manufacturers. Moreover, I found a fresh network of people to help me gain approval to deliver this lecture, and that whereas my thoughts around the accretive effect of complexity ran to a pattern but without significant order before this public work, to discuss it publicly I needed to build up the process complexity in a way that helped me better understand it myself. In this doctoral submission, I have added some necessarily brief speaker notes at intervals to aid understanding of this presentation.

In this manner, the process of preparing for this presentation became for me an enforced reflection-on-action piece of work, drawing on the auto-ethnographic response of an insider–researcher. In a way this helped me to set the mental frame for how to approach this wider doctoral submission some five years later.



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He leads a team of 8 planning managers and a wider team of 50 planners that Master Production Schedule the full range of products currently in production as well as leading this activity on launching products.

Phil leads and presents the transnational Sales and Operations planning process for the Wing and Pylon COE covering resourcing decisions for around 10,000 employees and has previously held other posts including Head of Logistics , in a 30 year plus career with BAe Systems and Airbus.

He is a member of the Chartered institute of Management and the Chartered Institute of Logistics and Transport (UK) and sits on the Council for Planning and Program Management at Airbus European level

Phil takes a very active interest in new product launches and ramp up activity and is passionate about finding a better way of pinpointing the 'tipping point' at which programs turn from being predictable and logical, to unpredictable/chaotic

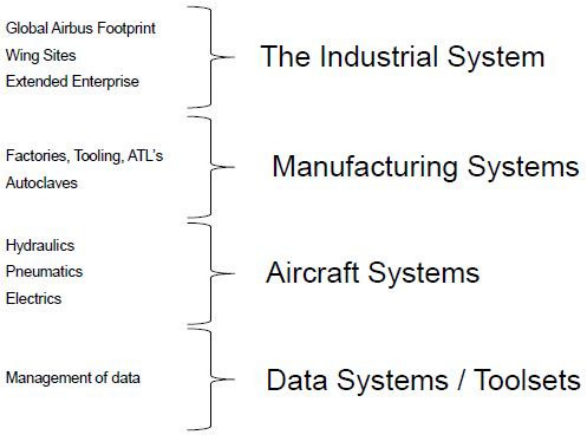
He lives and works near Chester and relaxes by oil painting and Salmon Angling

AIRBUS

Aim Of This Presentation

- Introduce the scale and complexity of Airbus
- Show how this complexity is built up in layers
- Share an understanding of the environment into which a major new project is launched and ramped up
- Provide opportunity for you to discuss/interpret

Systems source of complexity



The presentation began with my introduction as a presenter, then an outline of its aim (to show how complexity builds up in layers and how it presents itself, and with what attendant challenges).

Passengers at heart. Airlines in mind.

Welcome to the world of Airbus

Airbus' achievements by the end of 2008 included

- An annual turnover of 27,453M€
- A gross market share (units) of 51 %
- Delivering 483 aircraft and selling 900 in 2008
- Surpassing 9,215 aircraft ordered by 306 customers
- Supporting 5,267 aircraft in service with 310 operators
- Regularly achieving over 50% of large civil aircraft orders and deliveries

Data to end Dec 2008

AIRBUS

Evolution of the Airbus family

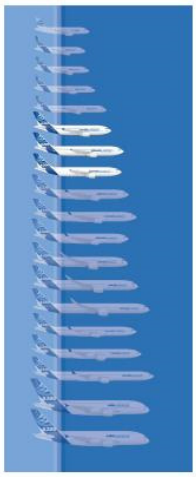
a world of innovation

- 9,409 *orders*
- 314 *customers*

- 5,937 *delivered to date*
- *483 delivered in 2008*

Data to end Nov 2009

AIRBUS

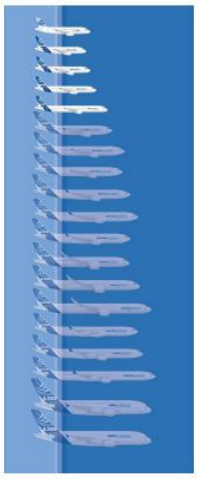


The A300/A310 Family

Strong foundations from which to grow

- The first Airbus aircraft
- The first twin engine widebody
- The first civil aircraft with a forward-facing two man cockpit
- The first civil aircraft with composites in secondary, and then primary structures
- The first civil aircraft to feature drag reducing wing tip devices

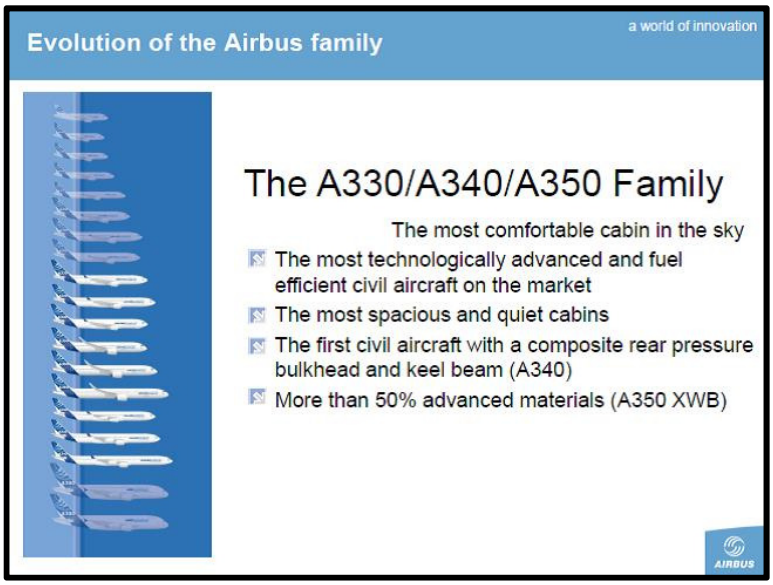
Evolution of the Airbus family
a world of innovation

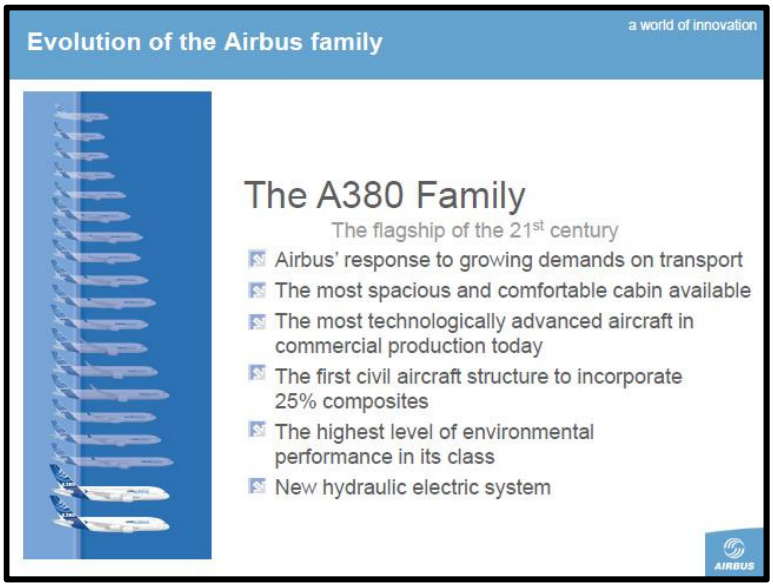


The A320 Family

The versatile answer for profitability

- The world's best selling aircraft family
- The widest single-aisle aircraft
- The first civil aircraft with full fly-by-wire and side stick control
- The lowest operating cost and highest residual values in its class
- The only business jet certified for public transport
- The first civil aircraft to have a composite tailplane and flaps





The early slides introduced the complex mix of product ranges, types and variants that all impact on the industrial system configuration.

Airbus transport

a world of innovation

The Beluga

- The most voluminous cargo hold in the world transports complete aircraft sections from Airbus' 12 manufacturing sites across Europe to the final assembly lines in Hamburg and Toulouse

Innovative logistics

- The transport system has been further optimised for the A380 with the introduction of custom built vehicles that operate on an integrated network of road, river and sea routes

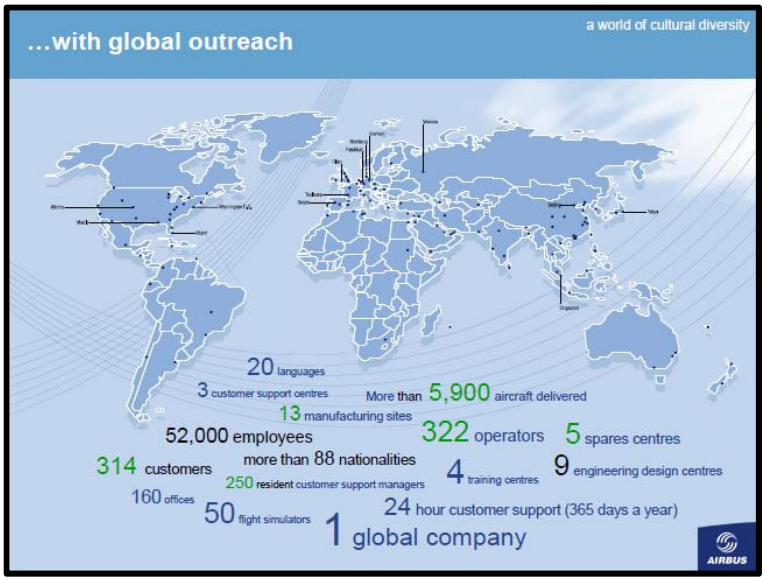
AIRBUS

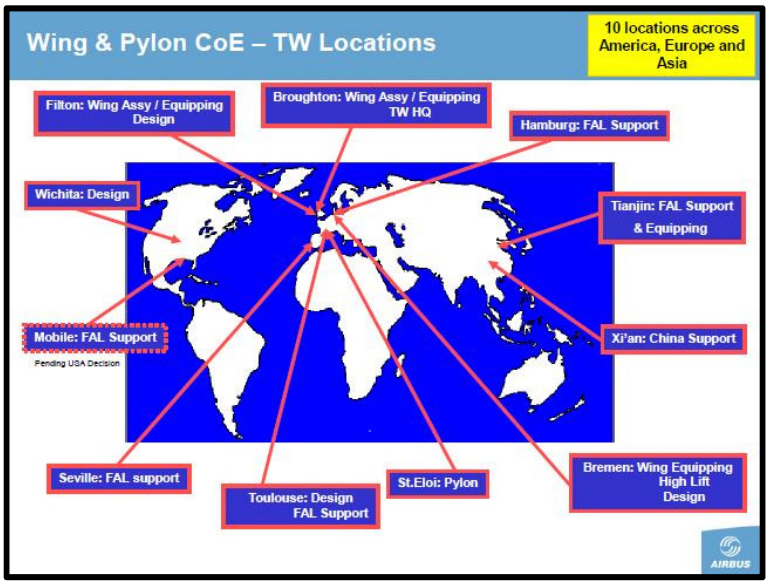
Airbus is a global company
52 000 employees worldwide, some 80 nationalities

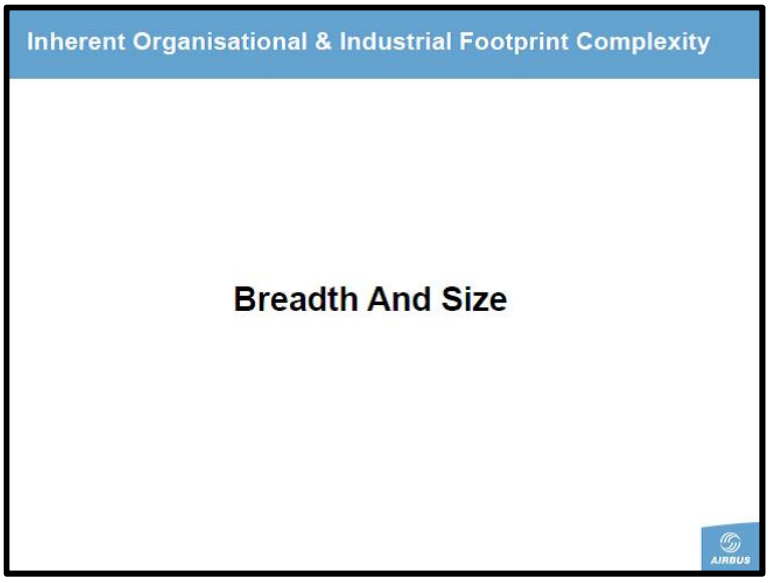
a world of cultural diversity

250 field service offices
11 engineering centres
5 spares centres
4 training centres


Rooted in Europe…
a world of cultural diversity
12 sites in Europe
Broughton
Filton
Stade
Hamburg
Bremen
Buxtehude
St Nazaire
Nantes
Toulouse
Madrid
Illescas
Puerto Real
Final Assembly Line
AIRBUS


…with global outreach
a world of cultural diversity
20 languages
3 customer support centres
More than 5,900 aircraft delivered
13 manufacturing sites
52,000 employees
322 operators
5 spares centres
314 customers
more than 88 nationalities
4 training centres
9 engineering design centres
250 resident customer support managers
160 offices
50 flight simulators
24 hour customer support (365 days a year)
1 global company
AIRBUS





Geographical complexity was introduced by explaining the number of factories and locations, along with the complex logistics operations that link them.

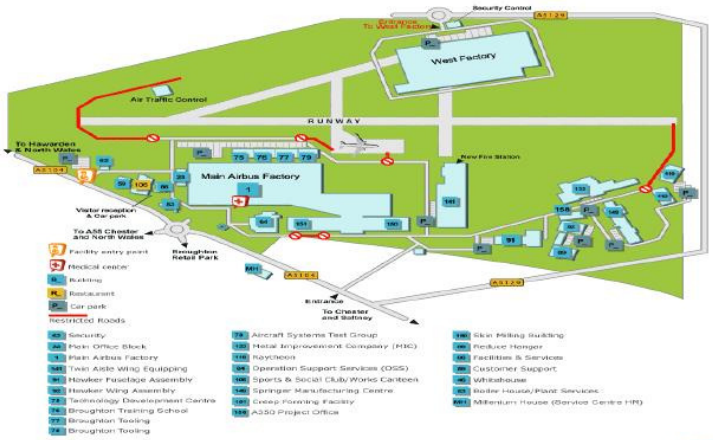
Broughton

The Broughton site is responsible for assembling wings for the whole Airbus family of aircraft prior to their delivery to the final assembly lines in Toulouse and Hamburg, - or in the case of A300, A310, A330 and A340 wings - to Bremen in Germany where all the moving or flying surfaces are fitted. The factory also manufactures and assembles fuselages and wings for Raytheon Hawker jets.

In its time, the Broughton factory has manufactured such famous aircraft as the De Havilland Comet and the Mosquito. Now its future lies firmly with Airbus.

Around 6,000 people work at Broughton, the majority in the manufacturing operation, the remainder in engineering and supporting business functions; for example procurement and finance.

Broughton Site Map



Broughton Site

Filton

Since 5 January 2009, the wing component and assemblies manufacturing unit ownership has been transferred to GKN.

Filton-based engineering and research and technology groups are responsible for wing design, including aircraft landing gear and fuel systems. Manufacturing of components and some wing sub assembly also takes place on site. In addition, the site has functions responsible for Airbus UK business management. Around 4200 people work at the Filton Site.

Engineering & Design Activities include Systems integration Design for manufacturability Structures and aerodynamics technologies, Selected aircraft sub-system integration and technologies, Reseach into the use of 'new materials' and advanced methodes of manufacturing and assembly Manufacturing Activities.

Complexity through scale was pointed to, with a reminder that these plants typically cover many square miles and employ thousands of people.

Bremen

Bremen is the second-largest Airbus site in Germany, with approx. 3,200 employees working in the fields of development, production, programme management and finance. One of Bremen's main activities is the development, design and manufacturing of high-lift systems for the wings of almost all Airbus programmes.

The development functions mainly involve flight physics, structural design, development and design of control systems and development and testing of new materials and manufacturing methods. Bremen's production activities are divided into three functions: manufacture of fuselage and wing structure components, structural assembly of high-lift systems and wing equipment installation.

Bremen Site Map

Bremen Site

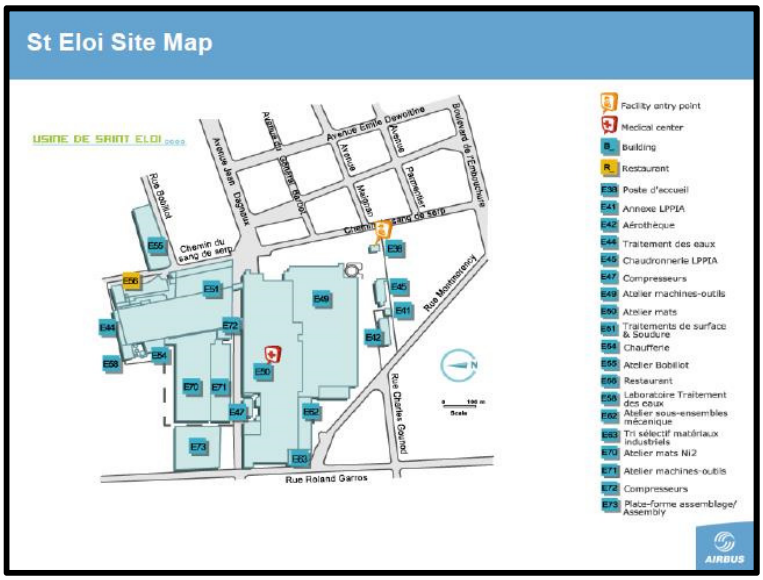
St Eloi

Saint-Eloi, "Pylons and Nacelles" Centre of Excellence, is specialised in the development, manufacture, assembly, equipping and testing of engine pylons and nacelles. It is the top European centre for hard metal machining and the transformation of titanium and hard metals.

Saint-Eloi makes extensive use of a flexible assembly workshop and technologies such as laser welding and hot forming of titanium.

Saint-Eloi is the oldest of the aeronautical plants in Toulouse. Founded in 1920 by Emile Dewoitine, it has taken part in the production of many prestigious aircraft: D1, 2338, D520, Armagnac, Caravelle, Concorde and the ATR and Airbus families.

Around 1000 people work at the St Eloi site.



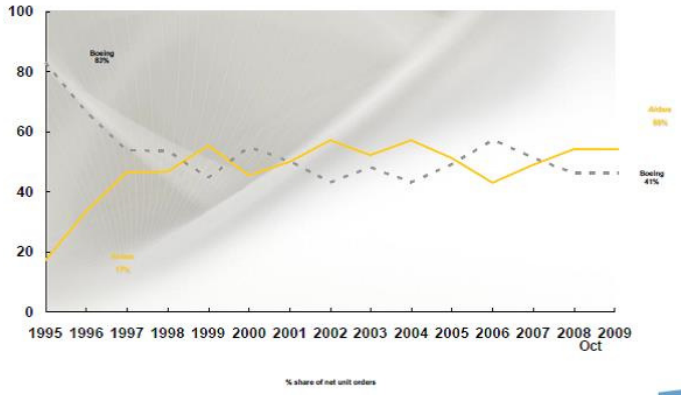
Cultural differences are to be overcome in dealing across European borders, with manufacturing units in France and Germany.

Wing Industrial Footprint Complexity Summary

The big 4 European sites

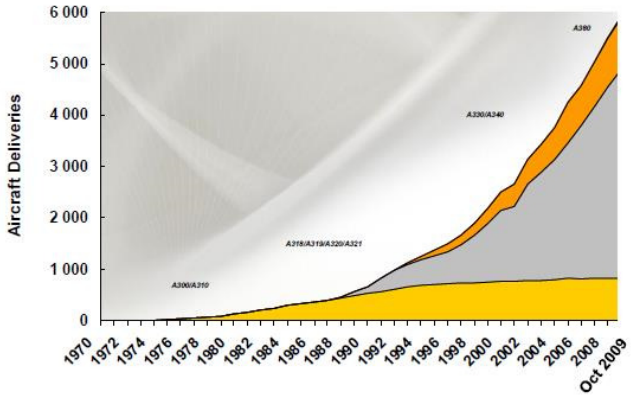
- 4 sites
- 10,000 employees
- Design
- Components
- Sub-assemblies
- Structural Assemby
- Systems Equiiping
- Tranportation

Airbus & Boeing Orders Evolution – Net Orders



A10- Current 7 (Sales & Market Shares)

Airbus Delivery Build-up



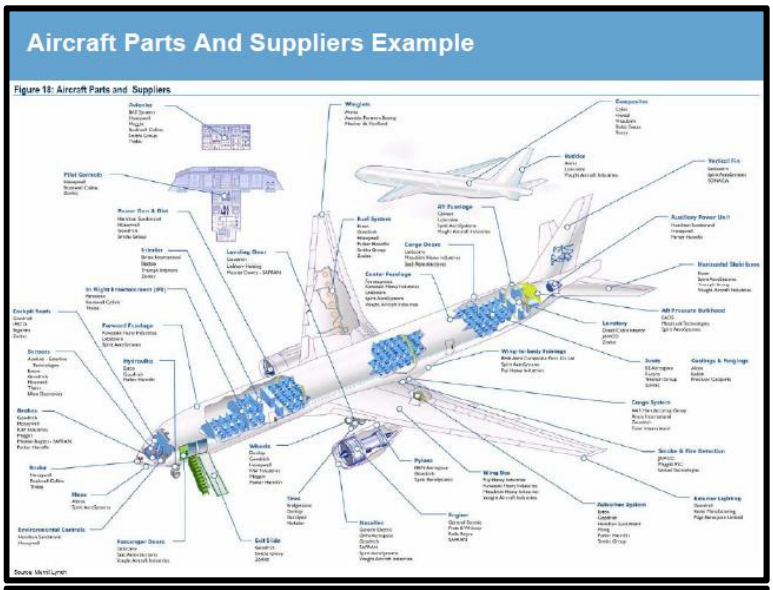
A10- Current 51 (Sales & Market Shares)

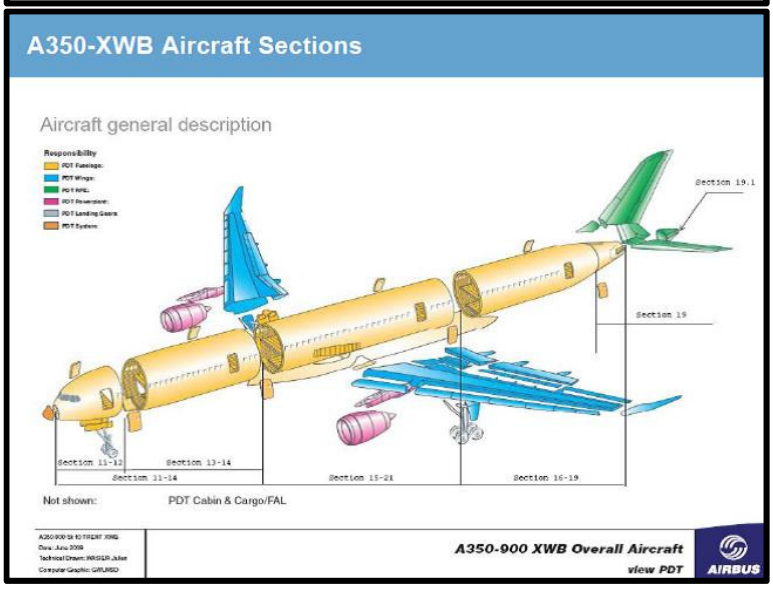
AIRBUS

Volume And Family

Volume And Family

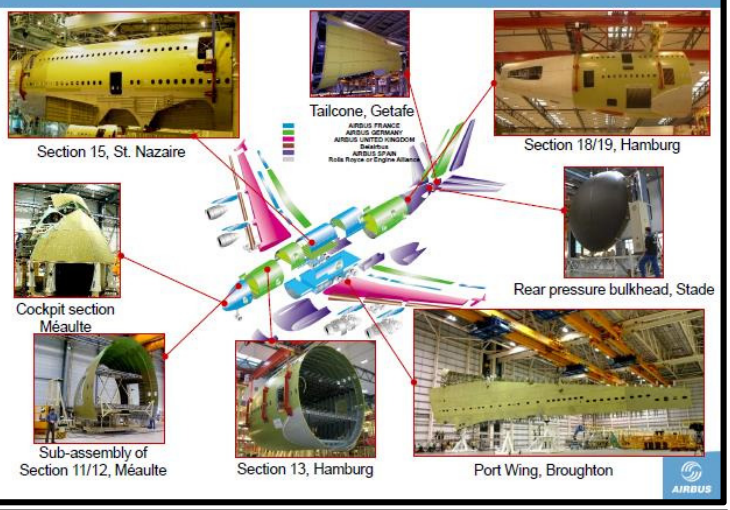
AIRBUS





I then introduced the complexity that accrues through the volume of aircraft produced (based on sales) and the added complexity that comes from the number of supplied parts to be managed for each aircraft.

A380 Major Component Assemblies



A350-XWB Extended Enterprise

As of today, 17 suppliers representing 31 Work packages are part of Airbus A350 XWB Extended Enterprise

Telair International
KAI
SPIRIT AEROSYSTEMS
Rockwell Collins
GKN AEROSPACE
Labinal SAFRAN Group
AOA luftfahrtgeräte gauting
S.A.B.C.A.
ac arles COMPLEX, S.a.
AEROLIA.
LATelec
AERnnova
EADS SOGERMA
DAHER-SOCATA
Alestis Aerospace
PREMIUM AEROTEC
PFW

A350 XWB Supplier Selections Status

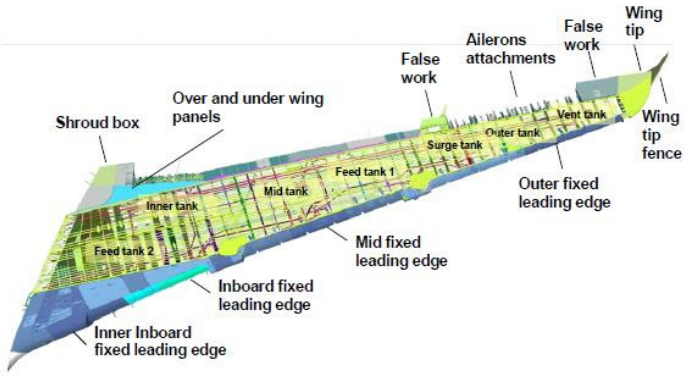
Page 33

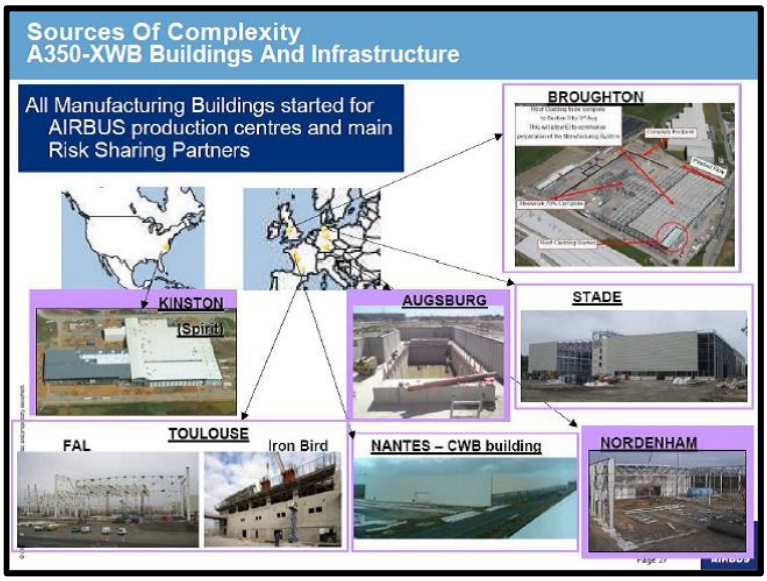
AIRBUS

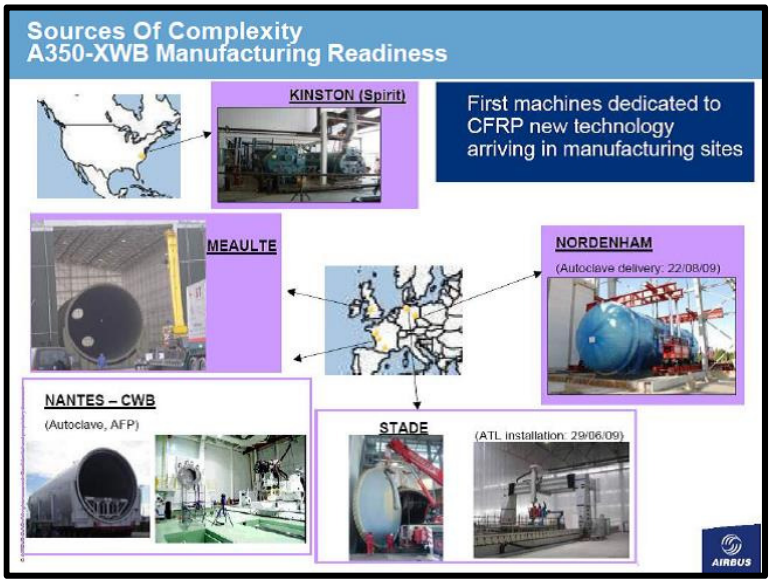
Airbus Procurement Commodities And Major Suppliers

•Aerostructures	21 suppliers
•Materials	20 suppliers
•Equipment	17 suppliers
•Propulsion	8 suppliers
•Consumables and services	16 suppliers
•Product services	36 suppliers
•IT and telecoms	14 suppliers

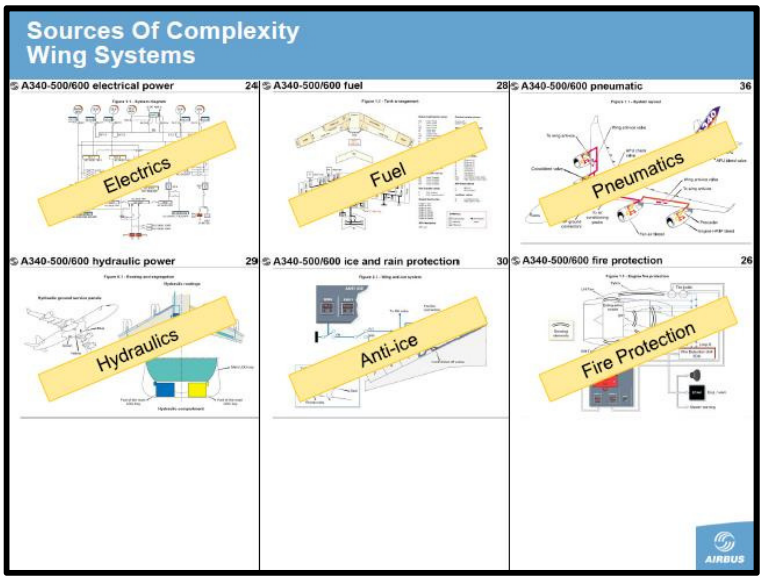
A380 Wing

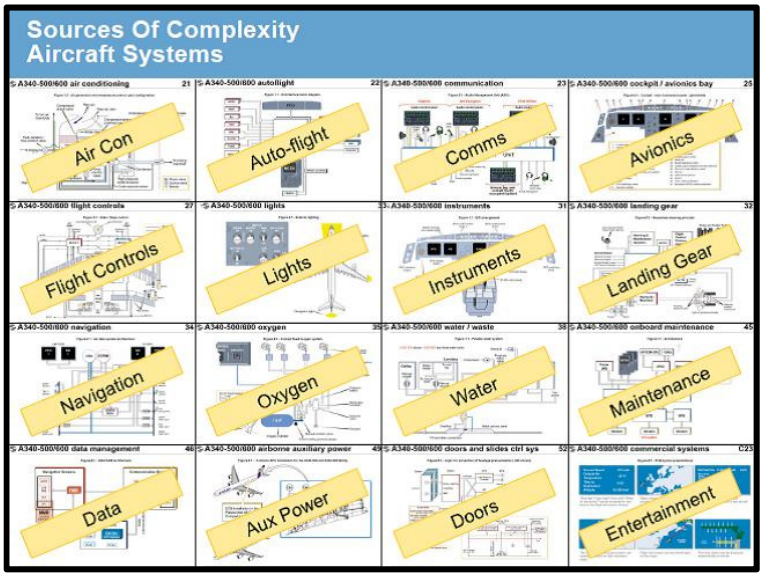




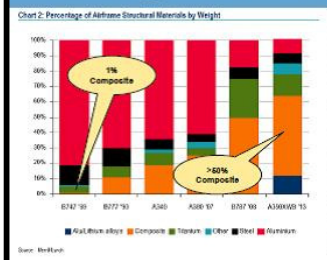


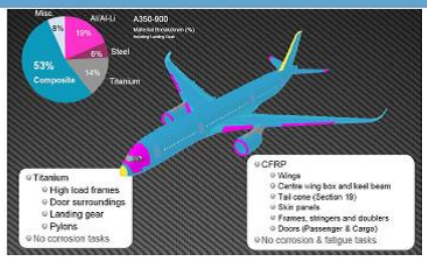
This volume complexity becomes compounded by the multiple sources of supply from large numbers of industrial partners, in a global supply chain spanning several time zones and covering millions of individual parts.


Sources Of Complexity
Wing Systems
A340-500/600 electrical power 24
Electrics
A340-500/600 fuel 28
Fuel
A340-500/600 pneumatic 36
Pneumatics
A340-500/600 hydraulic power 29
Hydraulics
A340-500/600 ice and rain protection 30
Anti-ice
A340-500/600 fire protection 26
Fire Protection
AIRBUS

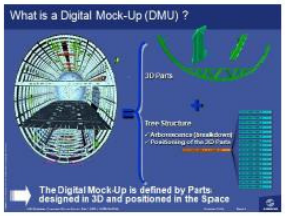

Sources Of Complexity
Aircraft Systems
A340-500/600 air conditioning 21
Air Con
A340-500/600 autoflight 22
Auto-flight
A340-500/600 communication 23
Comms
A340-500/600 cockpit / avionics bay 25
Avionics
A340-500/600 flight controls 27
Flight Controls
A340-500/600 lights
Lights
A340-500/600 instruments 31
Instruments
A340-500/600 landing gear 33
Landing Gear
A340-500/600 navigation 34
Navigation
A340-500/600 oxygen 35
Oxygen
A340-500/600 water / waste 38
Water
A340-500/600 onboard maintenance 45
Maintenance
A340-500/600 data management 46
Data
A340-500/600 airborne auxiliary power 49
Aux Power
A340-500/600 doors and slides ctrl sys 52
Doors
A340-500/600 commercial systems C25
Entertainment

Sources Of Complexity
Technology - A350-XWB Materials





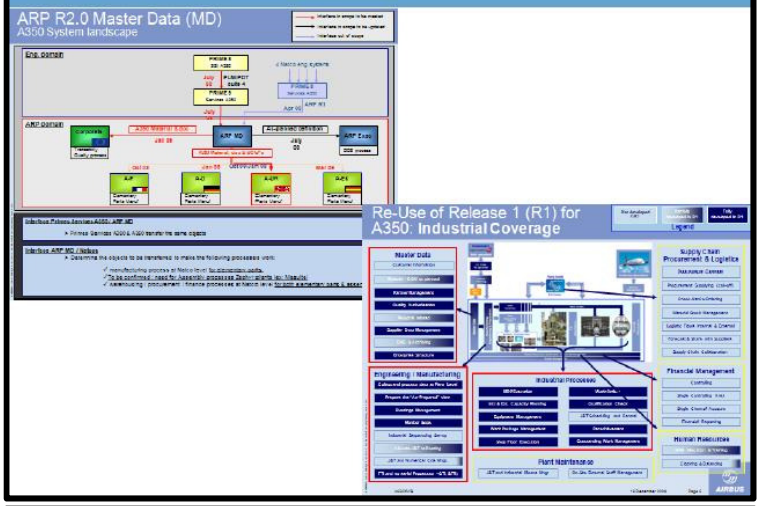
Sources Of Complexity
DMU's & Test Rigs



Structure & Systems Installation DMU

Early tests on systems benches

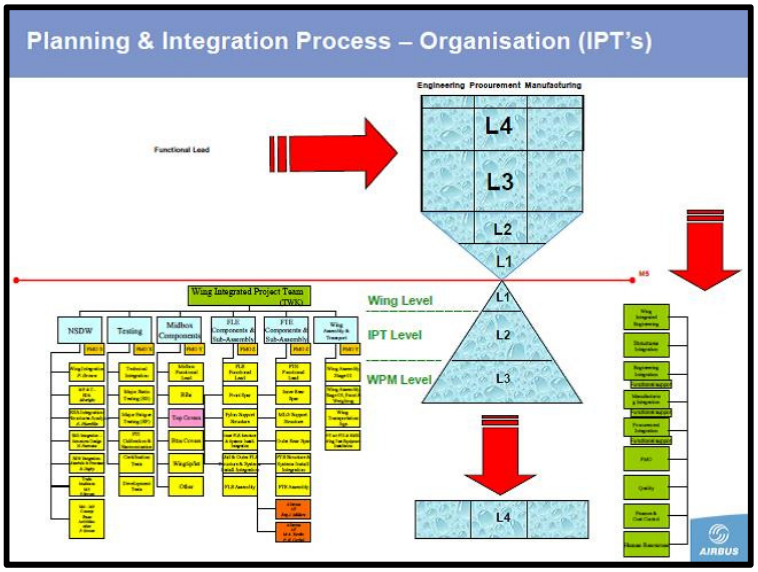
Technology Integration - Toolsets

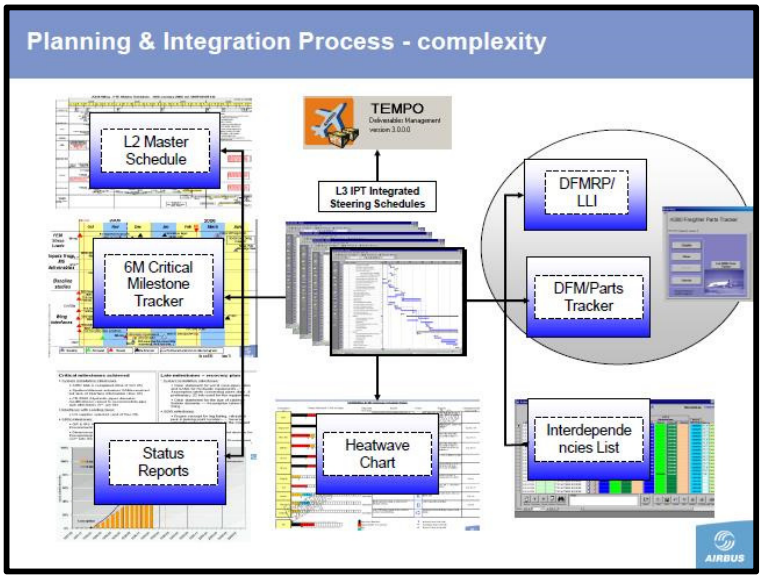


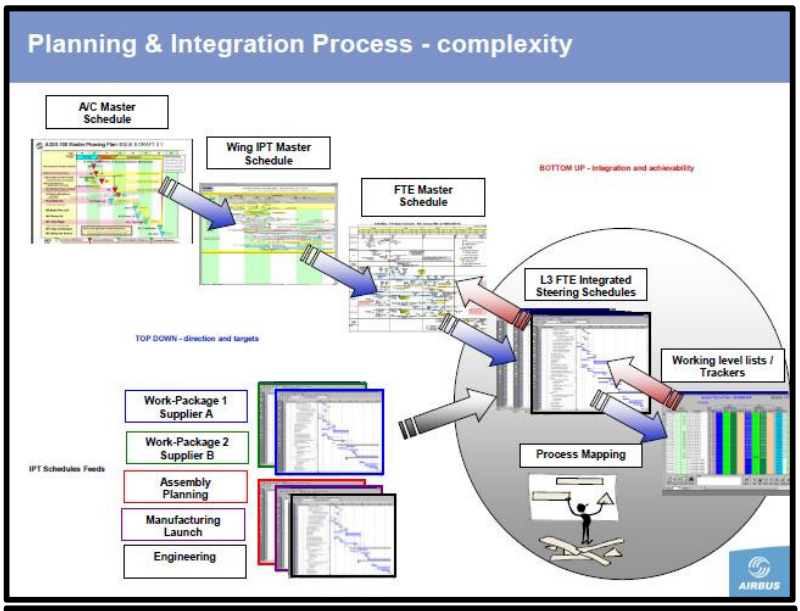
Systems source of complexity

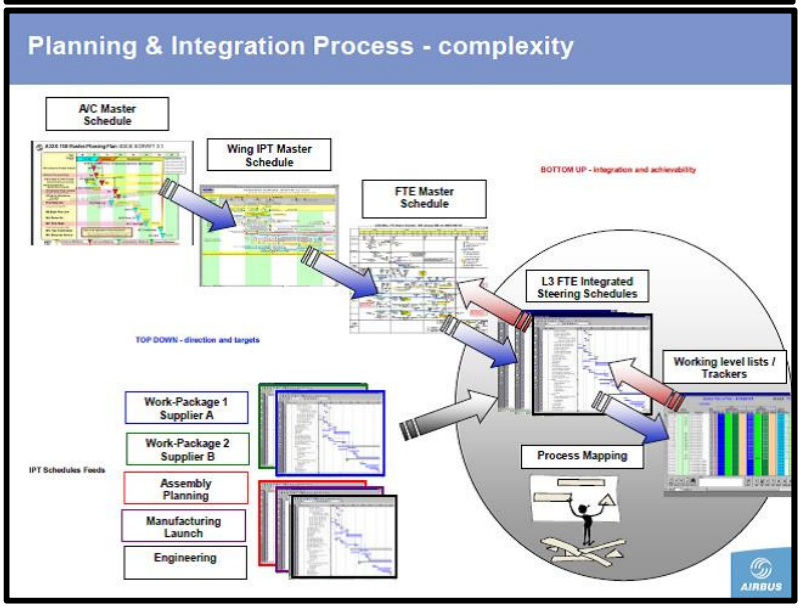
Global Airbus Footprint Wing Sites Extended Enterprise	The Industrial System
Factories, Tooling, ATL's Autoclaves	Manufacturing Systems
Hydraulics Pneumatics Electrics	Aircraft Systems
Management of data	Data Systems / Toolsets

These slides then expanded the subject by reminding the audience that technology, in the form of systems co-ordination at a wing and then aircraft level, brings with it issues of complexity – and the technology deployed to assist adds even more.






Planning & Integration Process - complexity
A/C Master Schedule
Wing IPT Master Schedule
FTE Master Schedule
BOTTOM UP - integration and achievability
L3 FTE Integrated Steering Schedules
TOP DOWN - direction and targets
Working level lists / Trackers
Work-Package 1 Supplier A
Work-Package 2 Supplier B
Assembly Planning
Manufacturing Launch
Engineering
IPT Schedules Feeds
Process Mapping
AIRBUS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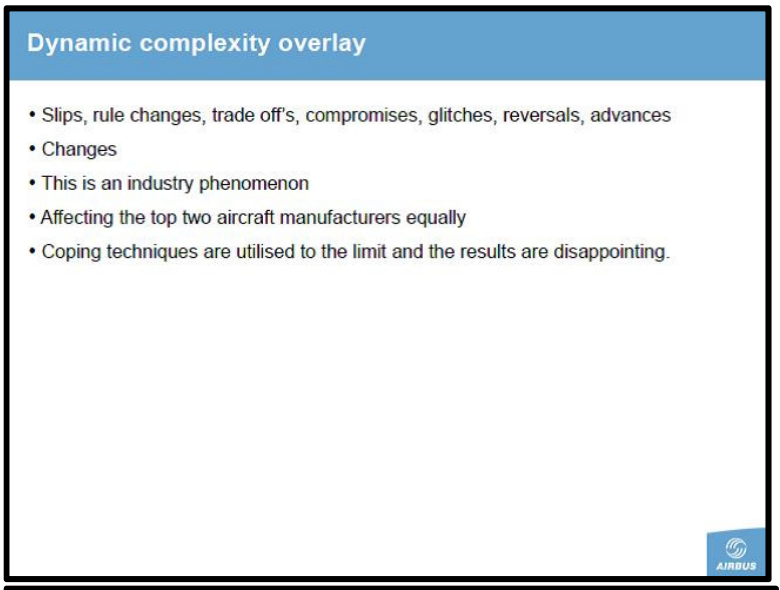
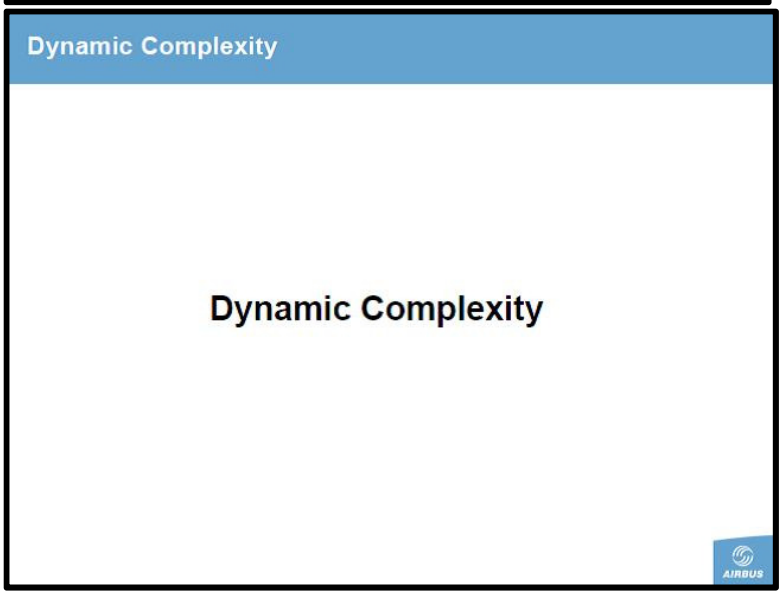
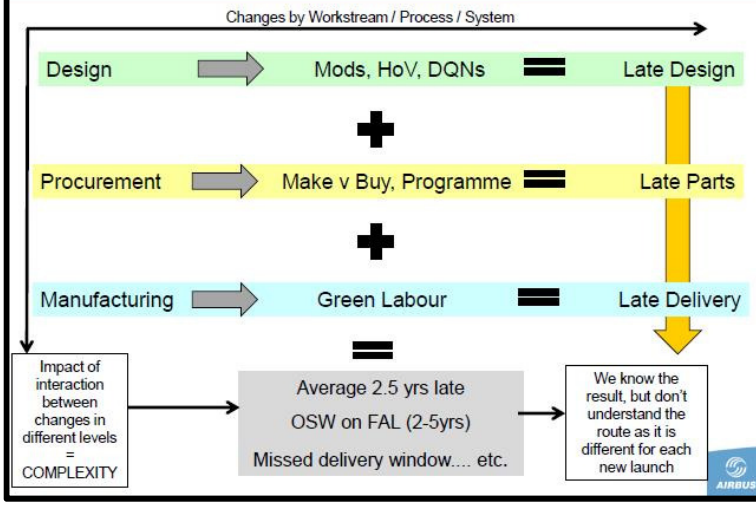




Planning in this environment can be challenged by organisational complexity such as reporting and accountability lines, process complexity in terms of data sources and accessibility, tool set constraints and reporting data volumes – and this is just for static, relatively unchanging or slow-moving data.

Layers of Complexity (not inclusive)



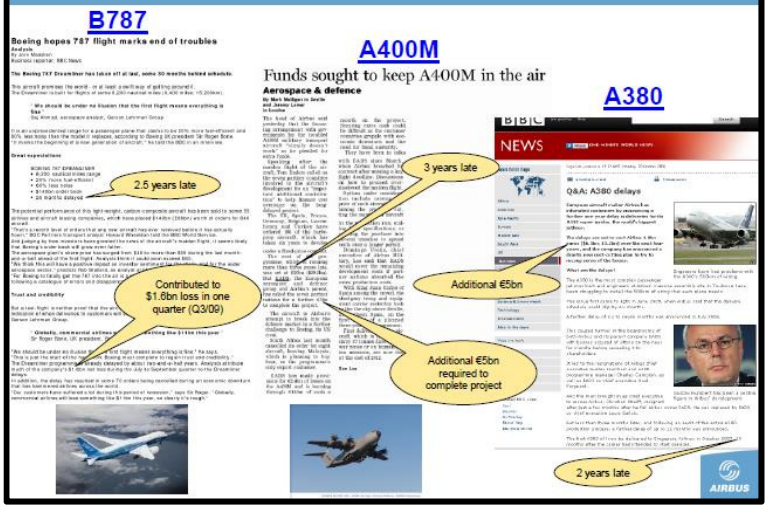
Dynamic Terminology

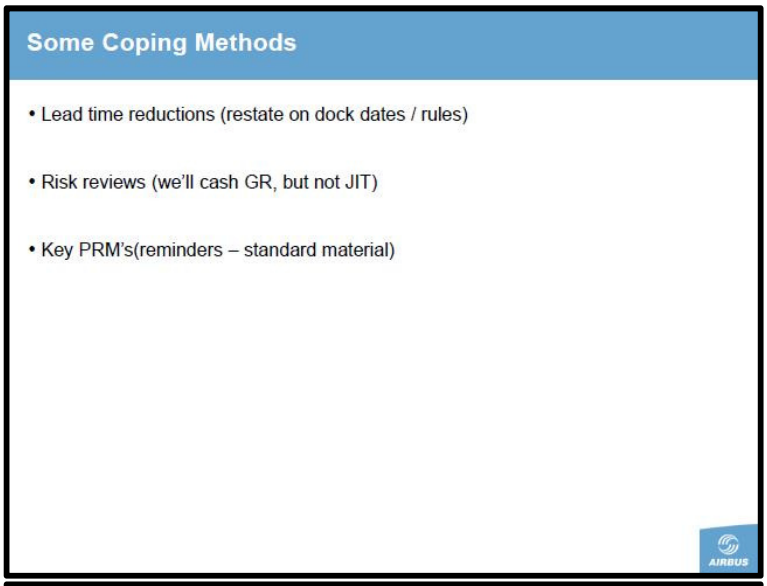
1. Aircraft design data slips
2. Key milestone freezes (IML / OML) slips
3. Tooling leadtimes / factories? (design and data changes)
4. Component leadtimes? (compressed)
5. Overlaps @ sub assembly and assembly level?
6. Whose rules? (Green / Amber / Red)

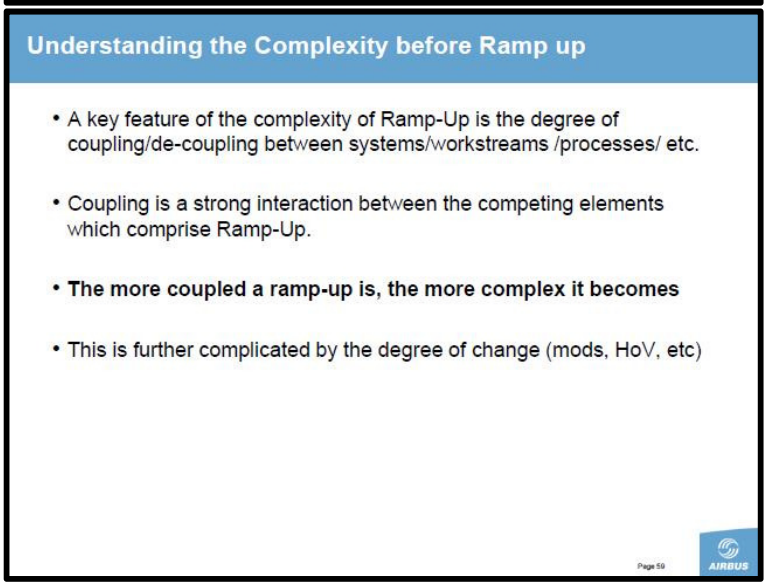
Value Judgement

- Is it red, black or amber? (not consistent in the UK, never mind other COE's)
- At what level of risk?
- Are we airfreighting, compressing goods receipt leadtimes or planning for JIT.
- How much compression is safe?
- How is the risk spread?
- Is it on track or not?

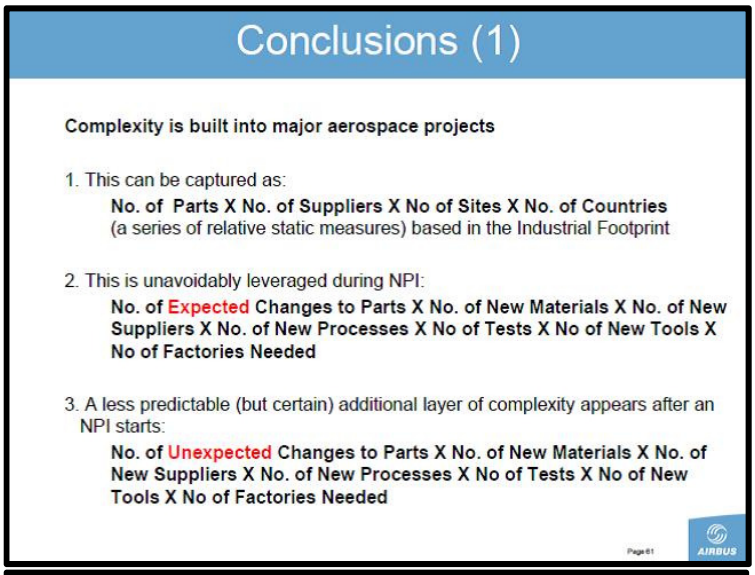
Some Press Observations

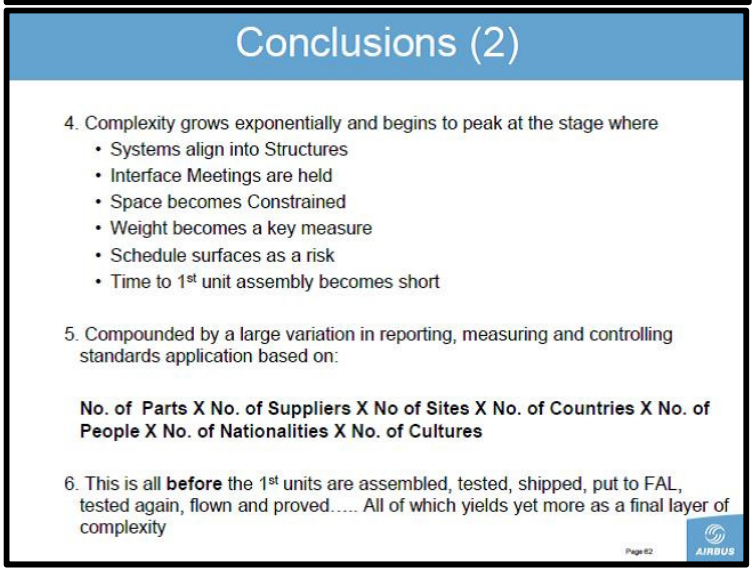


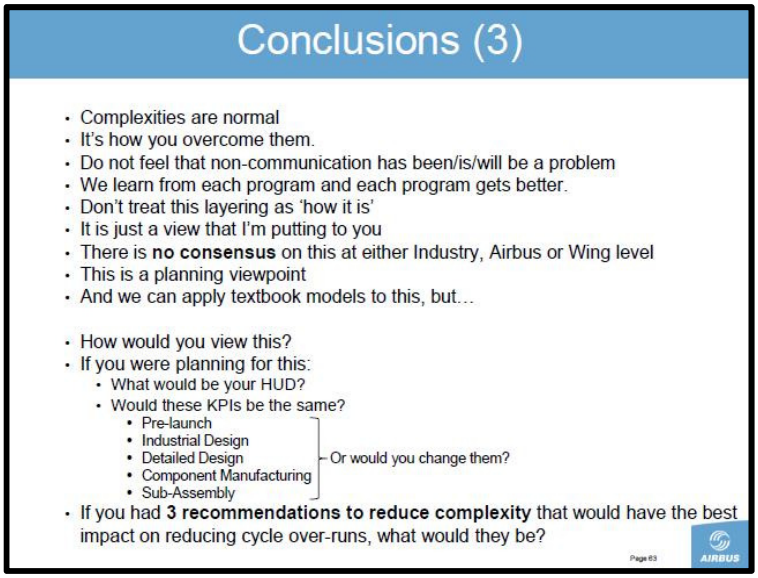




Dynamic instability, adding further complexity on top of the inherent static complexity, was explained as accruing from slippage in milestone achievements, such as receiving late drawings or parts.







Finally, I offered the conclusion that complexity in the aerospace example discussed comes from a combination of:

- the number of parts,
- multiplied by the number of suppliers,
- multiplied by the number of sites,
- multiplied by the number of countries.

During a new product launch, this is leveraged higher by:

- the number of **expected** changes to parts
- multiplied by the number of new materials
- multiplied by the number of new suppliers
- multiplied by the number of new processes
- multiplied by the number of new tools
- multiplied by the number of new factories required,

and that this multiplies further when all of the **un**expected changes to the above list occur.

I claimed that complexity grows exponentially during a launch and peaks at the points where: systems meet structures; interfaces need to be agreed and frozen; space allocation models become full; weight becomes a key measure; schedule surfaces as a risk; and the time available to the first unit of new build becomes short. This complexity is compounded by a large volume of and variance in reported progress data, not helped by dealing with varying cultures in different parts of the organisation across geographical boundaries and in a number of different countries.

I finished with a positive thought, which was to claim that complexities are normal; they are part of the excitement of working at this level in such a fascinating industry. We learn collectively and individually with each programme, and it is how you deal with this complexity that defines the learning. Some of what I have learned is contained in the public works extracts that constitute the remainder of this submission.

4.4.2 Contribution to learning and practice

Contribution to learning	Contribution to practice
Layers of complexity (4.4)	
The Oxford presentation is an example of a public work presented outside my company. Its contribution to learning lies in the linking of complexity, as a concept, to the practical experiences of a planner embedded in it and applying coping strategies in this context.	It is an example of the role of the planner in articulating and making comprehensible 'complexity' without reducing it to small disconnected parts. This would be replicating some of the literature issues cited in the introduction. A planner in a complexity context needs to have the skill to convey the environment holistically, paying attention to the interconnectedness of things. The planner belongs at the intersections, not only directing traffic flow but being the conduit for understanding between the different stakeholders. The planning team does not belong to any stakeholder island, but sits in the in-between-ness of things. Recognition of the constantly changing context within which scheduling complexity is situated and operates, and the need that this drives for flexibility and adjustment to cope, link in turn to their impact on shifts in support that may be expected.

Chapter 5 Conclusion

5.1 Conclusion and summing up

I start my conclusion with my impact on ways of working, because it is from this that the navigation of complexity, the use of tools and the dissemination of knowledge all flow.

What I have done here is to lead the process of focusing onto those planning roles that share a language and currency, therefore a shared ontology. In practice, this meant creating a community around planning for the assembly and equipping of aircraft wings. This needs to be understood as being profoundly different from planning in MRP systems for the provision of parts, as managing individual system error messages about scrap replacement or queries about store locations is as far removed from five-year capacity plans for thousands of people as is possible.

In large companies I have witnessed attempts to combine these roles, but the leading roles for each product stream simply became too big, migrating upwards to the executive level, and with a reach too great to do anything besides administer a large team as they became too stretched to recruit into, cope or last.

The alternative that I initiated was to use roles at plant senior management level that were high enough in the organisation to be heard, leading small teams in a high-turnover and high-influence environment, based on a hands-on application of planning knowledge. The answer was to establish a community; **a mini-COC** for planning that respected the cut-off that marks MRP and parts as different and out of scope. This left what I would call 'integrated planners' free to focus on that upon which all else depends, which is managing the order book changes into **major sections** scheduling. This drives all the employment and dependent parts supply–demand patterns for the plant.

My **impact on practice** was in deciding how to position this approach between not just MRP parts planning but HR, industrial, other functions, the plant organisation and pre-existing centres of competence such as engineering. This

meant my creating and driving a role that performed scenario analysis (like a project manager), planned (like a scheduler), that tracked progress (like a finance person) and logged improvement impacts on manning (like a lean team member). Crucially, I did all this in an integrated way that could be 'heard' in the organisation. This way of working is effectively a professional oasis in a niche that appears unique in Airbus (it appears nowhere in any of the 10 other sites), major industry and literature.

I led the integration of these planning roles because:

- The roles needed doing, and they needed doing well
- Selecting an integrated task set would help planners see the bigger picture.

If planners could see the bigger picture, such as the employment consequences, then:

- The detail would make more sense and they would be more likely to self-correct errors
- It would lift the tasks up into roles bestowing autonomy and the freedom to act
- It would be better for development and retention than managing them as fragmented administration tasks, as I have seen elsewhere in industry
- Organised well, they could help planners to grow and exercise judgement.

This would add to the practice of the plant and aid engagement.

I know that this integration approach works and has impact, because:

- It has survived decades of sponsorship, organisational and technological shifts

- 25% of planning direct recruits enter at a basic level, develop and then leave as senior managers or leaders
- It adds to documented practice at the cutting edge through papers and presentation material that are shared transnationally
- Consultants external to the company have acknowledged this practice as a benchmark.

The key is recognising integrated planning as an 'off blueprint' niche role in a large and complex organisation. There is a role for it in car plants, yet I have not seen it at any that I have visited. There is a role for it in aerospace but, again, I have not seen it exercised in the same way. There may well be a role for it in oil, gas and other industries where scale and scope are an issue, along with the management of complexity. I have seen sales and operations planning (S&OP) in place in a number of large companies, but to me the full integration from a shop floor planner, located by the product to headline sales changes in the board room, appears unique and absent from literature I have accessed. What also feels like my impact here is in reaching for 'that which works' on all of these subjects in this complex arena. I would define this as an easy, simple and sustainable answer that appeals to 'the common good', whether this is S&OP based on simple labour and volume views, or an organisation chart that hangs on a jigsaw piece of positioning and easy-to-absorb concepts such as 'is/is not'.

In tools and techniques, my impact has largely been on developing new approaches in new situations by concentrating on simplicity in the face of complexity, looking for **'what works'** as a theme. Red reports work as an antidote to complexity by focusing only on those things that have not occurred, as a best predictor of a future outturn based on accumulated experience.

5.1.1 On complexity itself

Complexity should be welcomed as a rich framework against which it is a privilege to be invited to commentate, plan for and counter. It can only be read by focusing on the whole rather than fragments of the picture. However, by selecting lenses that filter for certain aspects of the whole picture it is possible to interpret complexity with relatively brief data sets, much as the programming of

the Voyager spacecraft in its search for life on other planets. Voyager looked specifically for light on the dark side, methane in the atmosphere and irregular pattern radio waves (Sagan, 1994: 78). There are ways to concentrate all the indicators available, in their complexity, in order to focus on what really counts.

All this linking up of knowledge, tools and handling of complexity, stems from a clear vision of the gap that is left in a multidisciplinary linking of tasks. It lies at the heart of how I see integrated planning as an essential part of the eyes and ears of the plant. When it works well, it links what needs to be done and how to convey it in an ever-changing complex system, using steady judgement and knowledge-sharing in a secure reliable and useful way.

None of this implies that the other roles, such as MRP schedulers, are not needed; on the contrary, they are vital. A company needs PMOs to project manage the introduction of new jigs, product changes, factory extensions and so on, and MRP shop schedulers to manage the complexity of parts routings, store locations and max/min levels and so on. What I am contending is that a gap between these roles is an opportunity to integrate knowledge in a mini-integrated planning COC. My impact has been in seeing that integrated planning, with all of the benefits outlined earlier to the company, the individual and the management of complexity, can occupy the gap that left when you take an exclusively transactional/standard functional view, and then act to bring it about. But this is an 'off blueprint answer', and this is where an integrated planning COC differs from other primary communities such as ME, such that it needs papers and public works to explain it. This, in turn, is the gap that I hope this submission goes some way towards filling. I have chosen public works that bring this impact on practice alive for the reader/others, and this is where my claim of impact reaches out and connects with the samples of public works offered.

Once established, however, the retained knowledge-based developmental platform created by this approach, plus the ability to interpret and interact differently using tools such as red reports across disciplines, provides knowledge and shapes practice in a different way, and I deliver that here.

In this work I am not claiming that these were foresights; rather that, as auto-ethnography, this is the impact I had on practice and knowledge within this field;

that it worked in my tenure in post in a major multinational, in a world that has changed from tape and acetate planning to cloud computing and web-ex. It is what happened.

I believe that this is transferable understanding with potential impact beyond the domain that I describe here, and is worth considering in other settings that share some of the context of scale and complexity outlined earlier in which it operates.

There would be a gap in my reflections if I did not conclude with some thoughts on leadership. I have a leadership role at one level of the organisation that brings with it accompanying expectations from the highest levels of management and from those for whom I am responsible. It also brings into play the expectations I have of myself in such a role.

5.2 Leadership in this context

***'We manage things but we lead people.'* (Gill, 2009: 28)**

These are reflections that I hope are useful for other professionals. They are not intended to be an evaluation of the literature on leadership and where I fit in. In my context, the role of the planner involves in particular two layers in which leadership is required. I have a particular take on leadership in the planning context. First, there is the role of the lead planner in relation to the planning team. Secondly, there is the role of the planner in relation to all the stakeholders from the executive to the supplier, from the engineers to the production operators.

5.2.1 Planning team

I would see my role not so much as leading a team as facilitating and encouraging a planning team, not only to manage planning tasks, deadlines, outputs and meeting agendas but to think beyond that. Through an appreciative approach of what each has to offer and critical reflection, a lead planner encourages team members to think of complexity as that which not only requires 'management' of complexity through various artefacts, tools and devices but requires a navigational attitude to complexity. Such a conceptualisation encourages the planner to devise tools for that purpose

through collaboration with stakeholders, so that the tools contain the knowledge and experiences of others, which will ensure the uptake of their application.

Planners in complex industries are not made at universities and colleges. They learn their craft through working at the coalface. This learning will be limited if they learn how to do it solely as their predecessor did. The reason why such environments are described as complex is because they contain multiple stakeholders, responding variously to rapidly changing internal and external factors, and where the interdependency and interconnectedness of things can result in a problem in one area having a knock-on effect. The role of the planner is to contain such problems – not as firefighters, though this will be required at times, but as architects of systems that prevent a breakout in the first place or, at least, contain its impact. This is much like the idea of the super-organism in biology, particularly in the insect kingdom. The super-organism – the hive, for example – is not totally dependent on one part but can adapt so that the whole organism can survive and flourish. In my experience, in my context, this requires a clear conceptualisation of the role of the planner as architect of flexible systems of working and as navigator to underpin actions and the development of tools that both manage and prevent issues, and bring about repair/adaptive actions.

Of course, as the planning lead, particularly in times of crisis and critical incidents, at the end of the day it is the lead planner who has to steer the course.

5.2.2 Stakeholders

I see my role as lead planner also to be one of ensuring that everyone is linked though information, understanding and vision of the end goal, and how we might reach this. My leadership is one of engendering trust and constantly maintaining the conditions of that trust: collaboration; reliability; knowledge of all the components including methods, schedules and a seat at the decision-making table; an advocate of the planners; a management go between; a truthful translator; and with a track record of successful delivery. In conducting these two roles I would recognise my style from feedback I receive as comprising confidence in a vision, displaying a sense of purpose, persistence and trust in others, coupled with emphasising accomplishments rather than failures – all things that Gill (2009: 53) lists under transformational leadership. I see such a

leadership type as a facilitating conduit committed to certain values such as lifelong learning, being trustworthy and collaborative, appreciating others and sharing a vision. This facilitates changes in oneself and in others. I tend to exercise this kind of 'leadership' in more in smaller groups than loudly on a big stage.

Leadership, for me, also means using prior knowledge to help find a currency that will unite a perspective for people, what Mai and Akerson (2003: 67) describe as 'using stories to build community'. They go on to describe leaders discussing with their teams the meaning of the work, where it fits, why it matters and to what it contributes. I like the idea of a leader as a 'meaning maker' (ibid 2003: 33.) and aspire to this in the way that I exercise my lead planning role and in what I look for in people who 'lead' me. For example, capturing planning rules simply and on a page then labelling them 'cardinal' (from the Latin for hinge – on which all else hinges) has worked exceptionally well in capturing complexity. It has brought meaning to mass data, redefining knowledge and confronting the organisation with uncomfortable truths when it is in most need of them.

A leader, for me, needs to be an excellent translator and distiller of complexity and mass data without losing the essence of what is important and needs attention, in the context of complex work environments. I rely on the leadership above me to translate the internal and external factors that influence decisions without having to know every detail. I need to trust its skills in this. It needs to be able to trust my skills in doing the same for leadership, and for others with whom I work.

I see good leadership as being open to the views of others, acknowledging them and working together, setting aside bias, to see if we can achieve common goals. I would claim that this is evidence of acting in a **transdisciplinary way** (Maguire, 2012) with practices focused specifically on securing consensus across groups with very different ways of perceiving a goal. Here I recognise an 'intentional approach to transcend boundaries of disciplines and practices to create new knowledge synthesis within the individual or domain of practice and indeed in society'. **Integrated planning** is just that. Cardinal rules would not have sprung from a PMO with an event-only view, seeking to balance a plan for a review or from MRP, HR, industrial 'homes'. I also recognise elements of

'metanoia' (Maguire, 2012): a knowing beyond which is creative and transformative: another way of knowing.

I need to lead on key issues and during a crisis, but in normal 'run' mode I more often interpret the need as a task to smooth the way, not just for one discipline or player but across a number of interrelated disciplines. I see one of the key skills of a planning leader as creating the conditions for consensus on priorities. This is in an industry in which the organisational parts are intricately linked and where a set-back in one area will most likely have a detrimental effect on another, creating tools and techniques as part of the conditions required for a facilitative environment.

As a consequence of such reflection, in leading a team of planners through the context described I developed the mini-COC approach described here as an antidote to the challenging environment of multiple product launches or upgrades. I set out on purpose to create the ideal calm and appreciative conditions for planners to flourish in, as well. This resonates with what Hollins (1962: 19) says about planning in the building industry: 'Creative ability is always in short supply. It is usually best drawn forth by a comfortable and relaxed atmosphere, although in our industry, strains, pressures and tensions may make it difficult to find one.' I think that I did find that atmosphere: but it takes a great deal of sponsorship, explanation and engagement work to maintain it for the forty to fifty planners whom I now lead and the hundreds more that I have worked with and influenced over the years.

Linked to this interpretation of leadership in a complex environment is what Riggio et al. (2002: 10) refer to as 'successful intelligence', which is 'the ability to achieve success by one's own standards, given one's sociocultural context'. This is similar to the 'self-realiser' described by Sturges (Storey, 2011: 153). They go on to describe leaders who do this, 'recognising and capitalising on their strengths and by recognising and either correcting or compensating for their weaknesses'. This approach crosses over into leadership as 'practical intelligence', as it helps in adapting, shaping and selecting when faced with leadership dilemmas; and it helps inform selection choices at the recruitment stage to help balance weaknesses at the planning team level.

In all of the planning subjects that are encountered, my leadership impact is in reaching for **'that which works'**. This is how I add meaning for others and distil mass data into actionable information, in turn connecting this to recommended actions.

I believe that my approach to leadership in this setting has led me to conceptualise, design and implement a new approach to deploying planning knowledge that is at the forefront of its field.

5.3 Contributions to work practices and approaches in complex, manufacturing environments

The following is not comprehensively available in the current literature (see section 1.2) and therefore I hope will begin to address gaps in this field. It primarily raises and critiques the role of the planner in a complex environment with high stakes and multiple players. It offers a reconceptualisation of what lead planners do, which can lead to outputs of value to practice and to knowledge.

My route to this contribution is grounded in an unrepeatable sequence of occurrences and opportunities. This started with an individual fortunate enough to conduct practice in this field at some length, who was afforded enough autonomy to impact practice in a multinational company of some scale and complexity. This person had innate traits for reading for professional development and a drive to shape stakeholder engagement through public works. It is the lot of many senior practitioners to become so embedded in their work sectors and cultures that, after a time, they might begin to see and act on only that which is immediate; any forward thinking may become the view of the cultural lens with which they have operated for years. This can be implicitly avoidant of new thinking and practices, resulting in a replication of what worked before. It perhaps takes a few visits to other islands of knowing to begin to switch that lens and see not only what one has been doing but how one could do things differently in future. Progress is about having the capacity to adjust the lens.

I have worked in my environment for several years and have sought other ways of seeing and knowing, but casually rather than with real purpose, and often as a way of confirming current practice. I thought engagement with this doctoral

programme would be me articulating more of the same and going forward with the notion that what I was doing would be proved sound. Then I could go on replicating what I thought from my professional experience was right. Encounters with my adviser, Dr Kate Maguire, and other knowledge gained through widening my reading have seriously challenged how I think about my role, and the role of the lead planner generally, and how complexity can be navigated as well as managed. I have found other ways of articulating and conceptualising what we do, which has made sense of my contributions and more importantly may inform ways forward for future planners within the industry.

One of my first challenges was whether I could be separated from my outputs. What would happen to my outputs if I was no longer behind them? Over time, I realised that it was not that I was not doing things to guarantee succession but that I had never quite seen the issue in this way. I had needed to ensure flexible systems and views through a particular approach to conceptualising the role of the planner, thereby separating the agent of change (myself) from the means of change (attitudes, approaches). A concrete example might be in my deciding to position the approach to planning for complexity so that roles are placed between MRP, HR, industrial, functions, plant and other existing centres of competence (such as engineering), in an environment that encourages knowledge to be exercised and tools to be deployed differently. This supports an organisation of scale to cope with complex planning challenges. This required the conditions of trust discussed earlier.

By contrast, transacting administratively and functionally frustrates the ability to join all the data up, and act purposefully and in a transdisciplinary manner. For example, a PMO would naturally focus on one work package at a time (and may not be able to see the all-up perspective without help). Finance may well look to the budgeted headcount, but may miss the scale of risk that comes from engineered change or unexpected deviations from plan (and need help to interpret that), and so on. The influence on practice and learning that I claim here is that within the role of the planner is a shaping of a series of roles that bridge that gap in an integrated way and in creating the conditions in which they can flourish. This highlights the need to reshape and recontextualise the role of the professional planning practitioner. However, as Rimington and Pollack

(2007: 18), writing about complex projects, claim, 'No one framework fits all situations; but our research has indicated that expert practitioners tend to develop an almost intuitive understanding of how a complex situation can be appropriately simplified'.

My approach to finding a simple framework led to the creation of a planning role that, in an integrated way: performed scenario analysis (such as a PMO); that planned (such as a scheduler); that tracked progress (such as a finance person); and logged improvement impacts on manning (such as a process improvement team member). This provided the conditions for planners to use knowledge differently and deploy tools to help disseminate it, having prepared the environment to receive it positively as the framework made sense to the stakeholders in using their language and concepts.

I am not claiming that these were foresights. Rather, they were professional insights that arose from years of professional practice, through long delivery cycles and having to resolve complex problems in production. The evidence that they are sound is that they have been successful. The following section attempts to offer a summary of my thinking on reconceptualising the role of the professional lead planner in the context of a complex manufacturing environment. It is in a table format because I am a planner. I like tables as do many of my peers. It summarises and incorporates my shifts in thinking about the extended responsibilities of our roles as senior planners that have come to light through this critical reflection.

5.4 Proposals on leadership in complex planning

Professional role of the planning practitioner in complex environments	
Reconceptual ising role	The role of the senior planner is to create conditions for reflection-on-action leading to reflection-in-action, through: (i) an appreciative approach to team and stakeholder encounters and supporting the shared vision (ii) critical reflection as part of the development of planners. The senior planner is an agent for change, and the change has to exist independently of the agent who created/ has driven the change. The senior planner is a translator between members of the planning team, between the team and the stakeholders, between management/executive and the shop floor, and holds the role of facilitating the flow of understanding and collaboration between the different stakeholders and their practices and concerns. The senior planner creates tools as artefacts of experience and knowledge from different stakeholders to facilitate this flow. The aim is to arrive at the shared vision of stakeholders, e.g. the ability to create adaptive tools and contribute to developing practice, such as, in this case, the creation of cardinal rules and adaptation strategy (plan-on-a-page). The senior planner creates the conditions of trust, which include: a collaborative attitude; reliability; knowledge of methods; scheduling; translation of data; proven track record; an advocate; an able translator; non-partisan; safe. The senior planner works to create a flexible but reliable system of planning that uses the interconnectedness of things in a positive way, ensuring a problem in one area will not jeopardise others.
Existing literature	The senior planner contributes to addressing the gaps in existing literature related to comprehensive, integrated, flexible planning approaches that cannot be adequately addressed without the input of experts in the professional field of planning in complex manufacturing environments; to extract commonalities and differences in short-term, siloed project management and long-term projects in high-value industries. Currently, information is shared at conferences and workshops across such industries, but an effective strategy is needed to ensure high-level professional planners for the future. The senior planner provides a critiqued record of sustained deployment on practice that can contribute to revising a body of work built on theory, pilots or invitations to test outcomes and takes into account the human factor at all levels alongside technological advances in planning.

	The senior planner articulates what works and can be sustained in practice in a compound context drawn from a multi-company experience base, describing how the complexity and scale to be navigated will be found in the context of some products launching, while others are in series, some are at a preliminary stage, while others are at the delivery stage. So, navigating complexity is shown not to be a linear or sequential process, but is simultaneous, multi-layered, multi-dimensional and ongoing.
Strategy	To encourage critical reflection on practice by senior planners, new planners and interns. To propose a conceptualisation of the practice of a senior planner and of a working definition of complexity and the planner's role within it. To network effectively as senior planners to produce joint publications in professional and academic journals, and other artefacts that contain that knowledge. To pool knowledge resources and effective tools across these industries that can be effective in managing and navigating complexity.
Succession planning/ development of new planners for complex environments	Articulating expertise for future planners through capturing senior planners' critical reflections on their roles over time in the context in which planning operates; describing how the interaction with and outputs from planning varies with the phases of a programme, and how the intelligent planner's response needs to be in tune with this variation. Explaining why the organisational route taken and the culture (supportive/appreciative/developmental) *matters* in attracting talent and dealing with issues arising. The testing and positioning of integrated planning roles linking graduate trainees through to management positions, at a level in the organisation that is heard; located with the product, but in a mutually supportive matrix organisation with a strong core team that secures experience; in a structure capable of planning for three-year time horizons, down to shift-by-shift progress tracking, in a niche role that works in a trans-disciplinarily way to secure a result across Finance, HR, performance improvement and operational functions. Some useful examples of the different approaches to knowledge that may be unlocked with this integrated planning approach that reveals, conceptualises and articulates the accretive nature of planning skills and test situations for 'what matters' and 'what will work here'.

Returning to Davide Nicolini's view of practice theory mentioned in the opening pages of this document, I think he sums up more succinctly than I have my beliefs about my work in the complexity of multiple practices and the value of practitioner knowledge:

> Practices are, in fact, meaning-making, identity forming, and order producing activities…. Practice-based approaches consider cognition and sense making as emerging from practices carried out in an organisation…. In this sense, a practice based view is an alternative to cognitive perspectives that try to explain organisational conduct and phenomena as something stemming from the mind or brain of an individual. (ibid.: 13)

I am at the beginning of a journey that Nicolini has already mapped out with a broad brushstroke, inviting thinkers and practitioners:

> to embrace coherently a strong version of the practice approach, on the assumption that such an approach may yield a radically new way of understanding work organisations and organisational phenomena, albeit many of its affordances are still to be explored. (ibid.: 14)

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Appendices

Appendix 1 MPS snapshot

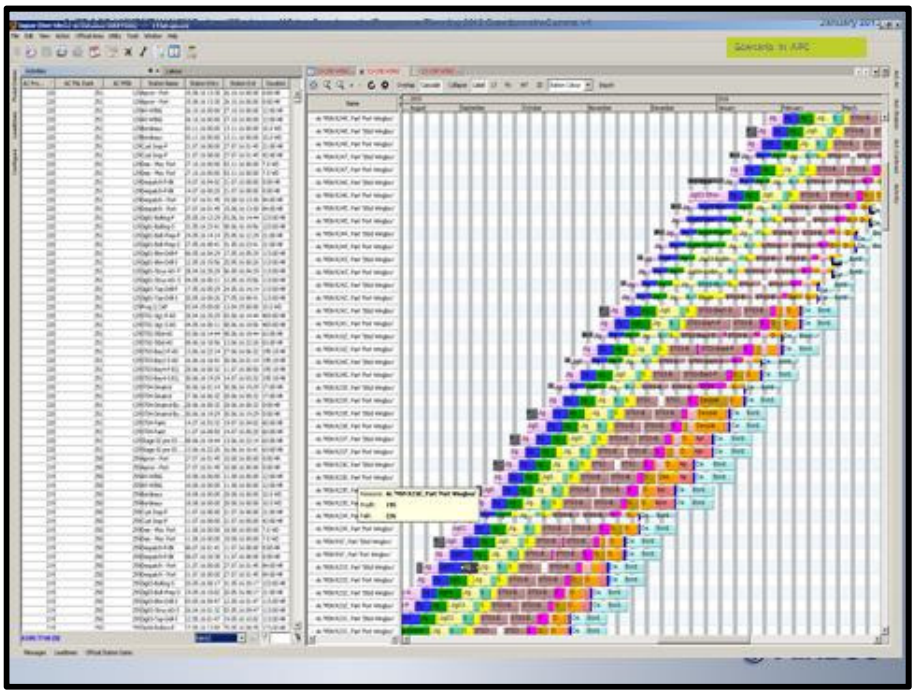

Figure 36 Example of a wing master production plan (MPS) Gantt chart

Source: Communications pack presented to all planning team in - Jan 2013 – P. Bailey

Notes: The vertical axis represents wing pairs in sequence reading up from the lower main serial numbers (MSNs) at the bottom left, to the higher MSNs (later build wings at upper left). The horizontal axis represents the calendar, with time now in the bottom left corner, and eight months later in this snapshot, being represented by the top right hand corner.

The phases of production are picked out in different coloured bars to help differentiate structural stages (towards the left of each cluster) from the equipping phases that follow (to the right of each cluster).

This visual representation helps set context to dates evolving from time now (bottom left) to an outcome in the future, where several wing pairs are planned to have undergone various phases of production. This is produced with each plan to aid understanding of the rest of the data which is often tabular and in text/date form.

Appendix 2 Artistic evidence

The way I process the world around me is essentially through pictures:

Figure 37 Processing the world visually (original oil painting by the author)

Source: Original artwork – oil on canvas – P. Bailey